

**Ústav anorganickej chémie SAV**



**Správa o činnosti organizácie SAV  
za rok 2018**

Bratislava  
január 2019

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# 1. Základné údaje o organizácii

## 1.1. Kontaktné údaje

**Názov:** Ústav anorganickej chémie SAV

**Riaditeľ:** doc. Ing. Miroslav Boča, DrSc.

**Zástupca riaditeľa:** doc. Ing. Miroslav Hnatko, PhD.

**Vedecký tajomník:** doc. Ing. Zoltán Lenčes, PhD.

**Predseda vedeckej rady:** RNDr. Jana Madejová, DrSc.

**Člen snemu SAV:** doc. Ing. Miroslav Hnatko, PhD.

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**Názvy a adresy detašovaných pracovísk:**

- **Vitrum Laugaricio - Centrum kompetencie skla, spoločné pracovisko ÚACH SAV, TnU AD, RONA, a.s. a FCHPT STU**  
Študentská 2, 911 50 Trenčín
- **VC SAV – Pavilón materiálových vied**  
Dúbravská cesta 9/6319, Bratislava
- **Pracovisko pre röntgenovú práškovú difraktometriu**  
Ústav merania SAV, Dúbravská cesta 9, 841 04, Bratislava 4

**Vedúci detašovaných pracovísk:**

- **Vitrum Laugaricio - Centrum kompetencie skla, spoločné pracovisko ÚACH SAV, TnU AD, RONA, a.s. a FCHPT STU**  
prof. Ing. Dušan Galusek, DrSc.
- **VC SAV – Pavilón materiálových vied**  
doc. Ing. Miroslav Boča, DrSc.
- **Pracovisko pre röntgenovú práškovú difraktometriu**  
doc. Ing. Miroslav Boča, DrSc.

**Typ organizácie:** Rozpočtová od roku 1953

## 1.2. Údaje o zamestnancoch

Tabuľka 1a Počet a štruktúra zamestnancov

Štruktúra zamestnancov	K	K do 35 rokov				F	P	T
		M	Ž	M	Ž			
<b>Celkový počet zamestnancov</b>	68	36	32	8	4	65	62.2	46.01
<b>Vedeckí pracovníci</b>	42	26	16	5	2	40	39.43	39.43
<b>Odborní pracovníci VŠ</b> (výskumní a vývojoví zamestnanci <sup>1</sup> )	7	4	3	2	1	6	5.58	5.58
<b>Odborní pracovníci VŠ</b> (ostatní zamestnanci <sup>2</sup> )	6	4	2	1	1	6	3.91	1

<b>Odborní pracovníci ÚS</b>	11	2	9	0	0	11	11.28	0
<b>Ostatní pracovníci</b>	2	0	2	0	0	2	2	0

<sup>1</sup> odmeňovaní podľa 553/2003 Z.z., príloha č. 5

<sup>2</sup> odmeňovaní podľa 553/2003 Z.z., príloha č. 3 a č. 4

*K – kmeňový stav zamestnancov v pracovnom pomere k 31.12.2018 (uvádzať zamestnancov v pracovnom pomere, vrátane riadnej materskej dovolenky, zamestnancov pôsobiacich v zahraničí, v štátnych funkciách, členov Predsedníctva SAV, zamestnancov pôsobiacich v zastupiteľských zboroch)*

*F – fyzický stav zamestnancov k 31.12.2018 (bez riadnej materskej dovolenky, zamestnancov pôsobiacich v zahraničí v štátnych funkciách, členov Predsedníctva SAV, zamestnancov pôsobiacich v zastupiteľských zboroch)*

*P – celoročný priemerný prepočítaný počet zamestnancov*

*T – celoročný priemerný prepočítaný počet riešiteľov projektov*

*M, Ž – muži, ženy*

Tabuľka 1b Štruktúra vedeckých pracovníkov (kmeňový stav k 31.12.2018)

Rodová skladba	Pracovníci s hodnotou				Vedeckí pracovníci v stupňoch		
	DrSc.	CSc./PhD.	prof.	doc.	I.	II.a.	II.b.
<b>Muži</b>	7	19	5	4	7	13	6
<b>Ženy</b>	2	14	0	0	2	7	7

Tabuľka 1c Štruktúra pracovníkov podľa veku a rodu, ktorí sú riešiteľmi projektov

Veková štruktúra (roky)	< 31	31-35	36-40	41-45	46-50	51-55	56-60	61-65	> 65
<b>Muži</b>	1	5	5	7	4	2	0	5	1
<b>Ženy</b>	1	2	1	6	2	2	1	2	0

Tabuľka 1d Priemerný vek zamestnancov organizácie k 31.12.2018

	Kmeňoví zamestnanci		Vedeckí pracovníci		Riešitelia projektov	
	A	B	A	B	A	B
<b>Muži</b>	46,6	45,0	45,8	44,3	45,7	44,5
<b>Ženy</b>	48,3	48,4	44,1	44,1	45,8	46,0
<b>Spolu</b>	47,4	46,7	45,1	44,2	45,8	45,1

*A - Prepočet bez zohľadnenia úväzkov zamestnancov*

*B - Prepočet so zohľadnením úväzkov zamestnancov*

### 1.3. Iné dôležité informácie k základným údajom o organizácii a zmeny za posledné obdobie (v zameraní, v organizačnej štruktúre a pod.)

Ústav anorganickej chémie SAV v roku 2018 nezaznamenal žiadne zásadné zmeny v organizačnej štruktúre aj napriek tomu, že sme mali pripravený zámer na zmodernizovanie a zefektívnenie fungovania ústavu. Vzhľadom na zmarenú transformáciu ministerstvom školstva a absurdným požiadavkám o okamžitom vytvorení dokumentov vrátane organizačného poriadku, nebolo možné v klude a rozumne sa tejto téme venovať.

Prepočítaný počet pracovníkov v roku 2018 je na úrovni 62,2 FTE, čo je porovnateľný stav s rokom 2017 (60,19). Do tohto počtu vstupujú aj traja štipendisti programu SASPRO a zamestnanci platení z projektov APVV. V roku 2018 ukončili pracovný pomer na ústave traja vedeckí pracovníci. Potešujúce je, že sa

podarilo zamestnať dvoch vedeckých pracovníkov, z toho jedného na kvalifikačnom stupni samostatného vedeckého pracovníka. V roku 2018 bol priemerný vek všetkých pracovníkov ústavu 47,4 roka a priemerný vek vedeckých pracovníkov 45,1. Vzhľadom na to, že nedochádza k plynulej generačnej výmene, postupne sa zvyšuje aj priemerný vek zamestnancov. Napriek tomu, že zamestnávanie mladých schopných postdoktorandov na ústave je jednou z hlavných priorít, nevieme ju v požadovanej miere primerane naplniť. Ak sa podarí nejakého mladého vedeckého pracovníka po skončení PhD štúdia zamestnať, tak len cez projekty, a to znamená, že na dobu 2-3 rokov, za tabuľkovú mzdu. Mnohí z mladých vedeckých pracovníkov takúto ponuku odmietnu. Motivácia mladých pracovníkov pre zotrvanie na ústave sa realizuje predovšetkým prostredníctvom poskytnutia možnosti zvyšovania ich kvalifikácie (stupeň IIb, IIa a Ia). Zvyšovanie kvalifikácie vedeckých pracovníkov má logicky za následok zvýšený tlak na mzdový fond. Tento fakt by mohlo pri tvorbe rozpočtu, hlavne mzdových fondov ústavov, zohľadniť aj vedenie SAV pri presadzovaní vlastnej mzdovej politiky v rámci SAV. Ústav sa od roku 2008 podieľal na realizácii 13-tich projektov financovaných zo ŠF EÚ, ktoré sú aktuálne všetky ukončené. Aj napriek tomu, administratívne zaťaženie na ich monitoring ostáva, pričom mzdové náklady na túto administráciu už nie je možné vykrývať z projektov, ale len zo mzdového fondu. Navyše, výraznú časť administratívnych výkonov preberajú aj vedeckí pracovníci.

## 2. Vedecká činnosť

### 2.1. Domáce projekty

Tabuľka 2a Domáce projekty riešené v roku 2018

ŠTRUKTÚRA PROJEKTOV	Počet		Čerpané financie (€)					
	A	B	A				B	
			Zo zdrojov SAV		Z iných zdrojov		Zo zdrojov SAV	Z iných zdrojov
			Spolu	Pre organizáciu	Spolu	Pre organizáciu		
1. Projekty VEGA	9	2	104 967	104 967	-	-	6 625	-
2. Projekty APVV	8	3	-	-	418 949	287 435	-	42 480
3. Projekty OP ŠF	0	0	-	-	-	-	-	-
4. Projekty SASPRO	3	0	167 528	167 528	-	-	-	-
5. Projekty centier excelentnosti SAV	0	0	-	-	-	-	-	-
6. Iné projekty (FM EHP, ŠPVV, Vedecko-technické projekty, ESF, na objednávku rezortov a pod.)	0	0	-	-	-	-	-	-

A - organizácia je nositeľom projektu

B - organizácia sa zmluvne podieľa na riešení projektu

Tabuľka 2b Domáce projekty podané v roku 2018

Štruktúra projektov	Miesto podania	Organizácia je nositeľom projektu	Organizácia sa zmluvne podieľa na riešení projektu
1. Účasť na nových výzvach APVV r. 2018	-	3	3
2. Projekty výziev OP ŠF podané r. 2018	Bratislava Regióny		1

**Názov projektu:** Výskum a vývoj akumulčných nádrží z nových, žiaruvzdorných a kompozitných materiálov

**Evidenčné číslo projektu:** NFP313010Q834

**Žiadateľská organizácia:** PREFA ALFA, a.s.

**Partner/i:** ÚACh SAV

**Stav:** podaný

**Názov projektu:** Korózia a zvetrávanie úžitkových skiel

**Evidenčné číslo:** APVV 18-0245

**Podávateľ projektu:** M. Liška, TnUAD

**Partneri:** ÚACh SAV, RONA a.s.

**Stav:** podaný

**Názov projektu:** Povrchy polymérov modifikované vrstevnatými nanočasticami a fotoaktívnymi farbivami

**Evidenčné číslo:** APVV-18-0075

**Akronym:** PolyNanoPhoto

**Podávateľ projektu:** J. Bujdák, Prírodovedecká fakulta UK

**Partneri:** ÚACh SAV

**Stav:** podaný

**Názov projektu:** Bentonit: strategická surovina Slovenska - inovatívne hodnotenie kvality pre jej efektívne využívanie

**Evidenčné číslo projektu:** APVV-18-0391

**Akronym:** Bentonit - vlastnosti, vznik, využitie (BEN3V)

**Podávateľ projektu:** P. Uhlík, Prírodovedecká fakulta UK

**Partner/i:** ÚACh SAV, Ústav vied o Zemi SAV

**Stav:** podaný

**Názov projektu:** Vývoj bioaktívneho nitridu kremičitého modifikáciou povrchovej vrstvy

**Evidenčné číslo projektu:** APVV-18-0542

**Acronym:** BioSurf

**Podávateľ projektu:** M. Tatarková, ÚACh SAV

**Partner/i:** Centrum pre využitie pokročilých materiálov, CEMEA

**Stav:** podaný

**Názov projektu:** Joining of advanced SiC-based ceramic materials and their service performance evaluation

**Evidenčné číslo projektu:** SK-CN-RD-18-0011

**Acronym:** JOINCER

**Podávateľ projektu:** P. Tatarko, ÚACh SAV

**Partner/i:** Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences

**Stav:** neschválený

**Názov projektu:** Vysokoteplotné karbidy pre aplikácie v extrémnych podmienkach

**Evidenčné číslo projektu:** SK-SRB-18-0022

**Acronym:** CerEx

**Podávateľ projektu:** P. Tatarko, ÚACh SAV

**Partner/i:** Belgrade University, Institute for Nuclear Sciences, Materials Science Laboratory

**Stav:** podaný

## 2.2. Medzinárodné projekty

### 2.2.1. Medzinárodné projekty riešené v roku 2018

Tabuľka 2c Medzinárodné projekty riešené v roku 2018

ŠTRUKTÚRA PROJEKTOV	Počet		Čerpané financie (€)					
	A	B	A				B	
			Zo zdrojov SAV		Z iných zdrojov		Zo zdrojov SAV	Z iných zdrojov
			Spolu	Pre organi-záciu	Spolu	Pre organi-záciu		
<b>1. Projekty 7. RP EÚ a Horizont 2020</b>	1	0	-	-	37 991	37 991	-	-
<b>2. Projekty ERA.NET, ESA, JRP</b>	1	1	-	-	-	-	-	10 000
<b>3. Projekty COST</b>	0	1	-	-	-	-	-	-
<b>4. Projekty EUREKA, NATO, UNESCO, CERN, IAEA, IVF, ERDF a iné</b>	1	0	-	-	-	-	-	-
<b>5. Projekty v rámci medzivládnych dohôd</b>	0	0	-	-	-	-	-	-
<b>6. Bilaterálne projekty MAD</b>	2	0	-	-	-	-	-	-
<b>7. Bilaterálne projekty ostatné</b>	2	1	-	-	-	-	-	-
<b>8. Podpora MVTS z národných zdrojov (SAV, APVV a iné)</b>	4	1	48 998	48 998	3 929	3 929	4 107	-
<b>9. Iné projekty</b>	0	0	-	-	-	-	-	-

A - organizácia je nositeľom projektu

B - organizácia sa zmluvne podieľa na riešení projektu



## 2.2.2. Medzinárodné projekty Horizont 2020 podané v roku 2018

Tabuľka 2d Počet projektov Horizont 2020 v roku 2018

	A	B
<b>Počet podaných projektov Horizont 2020</b>		2

A - organizácia je nositeľom projektu

B - organizácia sa zmluvne podieľa na riešení projektu

**Názov projektu:** Plasma-Pulse Geo-Drilling (PPGD) – A novel drilling technology to reach cost-effectively depths in the order of 5 km and/or temperatures higher than 250 deg C.

**Evidenčné číslo projektu, výzva:** SEP-210515838, H2020-LC-SC3-2018-2019-2020

**Akronym:** PPGD

**Podávateľ projektu:** Uppsala Universitet

**Partner/i:** SwissGeoPower Engineering AG, Divident Industries Aktienbolag, Eidgenoessische Technische Hochschule Zuerich, HSR Hochschule fur Technik Rapperswill, Ústav anorganickej chémie SAV, ZTS Inmart, a.s., VUNAR a.s., Nemo-Q International AB

**Stav:** neschválený

**Názov projektu:** Advanced nano-ceramics for green and environmental technologies

**Evidenčné číslo projektu, výzva:** 814304, H2020-MSCA-ITN-2018

**Acronym:** ADVANTAGES

**Podávateľ projektu:** CNRS, France

**Partner/i:**

Nemecko (Technische Universität Darmstadt, Universität Bayreuth, Merck), Slovensko (Ústav anorganickej chémie SAV, Bratislava, Danubia Nanotech), Taliansko (Universita degli Studi di Padova, Università degli Studi di Trento), Rakúsko (Universität Innsbruck), Švajčiarsko (Engicer SA), Francúzsko (Saint-Gobain Research Center, IMECA Process), Japonsko (Nagoya Institute of Technology), USA (Clemson University)

**Stav:** neschválený

Údaje k domácim a medzinárodným projektom sú uvedené v Prílohe B.

## 2.2.3. Zámery na čerpanie štrukturálnych fondov EÚ v ďalších výzvach

VÝZVA NA PODPORU DLHODOBÉHO STRATEGICKÉHO VÝSKUMU A VÝVOJA – PRIEMYSEL PRE 21. STOROČIE, KÓD OPVAI-VA/DP/2018/1.2.1-05

**Materiály pre efektívnu výrobu, konverziu, transport, uskladnenie a bezpečné využívanie energie** (Akronym: M4E)

Univerzita Pavla Jozefa Šafárika v Košiciach, SPINEA Technologies s.r.o., Technická univerzita v Košiciach, Univerzita J. Selyeho, Ústav anorganickej chémie Slovenskej akadémie vied, Ústav experimentálnej fyziky SAV, Ústav geotechniky Slovenskej akadémie vied, Ústav materiálového výskumu SAV, ZEOCEM a.s.

**Výskum efektívneho využitia plazmového pulzu pre konštrukciu nerotačného horizontálneho raziaceho systému v kryštalických horninách.**

Žiadateľ: VUNAR, a. s. Nové Zámky

Ústav anorganickej chémie Slovenskej akadémie vied, Prefa Alfa, a. s., ZTS Inmart a. s, Technický a skúšobný ústav stavebný, STU Bratislava Strojárska fakulta, UGt SAV Košice

**Výskum využiteľnosti nekovových materiálov pre výrobu akumulátorov tepelnej energie a pre výrobu energetickej pilóty**

Žiadateľ: PREFA ALFA, a. s.

Ústav anorganickej chémie Slovenskej akadémie vied, VUNAR a. s., ZTS Inmart a. s, Technický a skúšobný ústav stavebný, Trenčianska univerzita Alexandra Dubčeka v Trenčíne

**Gama radiačná záťaž sklovláknitých izolácií a bezpečné chladenie pri ťažkých haváriách v JE**

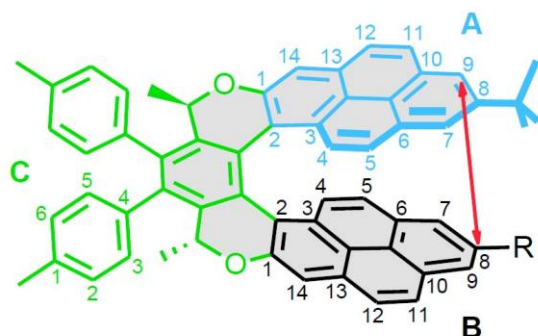
(GAŤAH)

Žiadateľ: VÚEZ, a. s., Levice

Ústav anorganickej chémie Slovenskej akadémie vied, Trenčianska univerzita Alexandra Dubčeka, Trenčín,  
Fyzikálny ústav Slovenskej akadémie vied, Výskumný ústav chemických vlákien**2.3. Najvýznamnejšie výsledky vedeckej práce** (maximálne 1000 znakov + 1 obrázok; bibliografický údaj uvádzajte rovnako ako v zozname publikačnej činnosti, vrátane IF)**2.3.1. Základný výskum****Vodík-vodíkové vzájomné pôsobenie pozorované pomocou nepriamej NMR interakcie cez priestor**

Riešiteľ z ÚACH: Oľga Malkina

Nepriama spin-spinová interakcia cez priestor medzi vodíkovými atómami, formálne oddelenými až 18 kovalentnými väzbami, bola po prvýkrát vôbec pozorovaná pomocou NMR experimentov na modelových helikálnych molekulách. Priama vzdialenosť medzi interagujúcimi protónmi bola okolo 3 Å. Ukázali sme, že toto vzájomné pôsobenie môže poskytnúť zásadnú informáciu o molekulárnej konformácii v roztoku. Interakčné dráhy boli vizualizované a analyzované výpočtovými metódami. Na základe tejto analýzy bol vysvetlený novoobjavený jav.



Rozostup medzi fragmentami A a B (červená šípka) je 3.4 – 5.2 Å.  
Priama vzdialenosť medzi interagujúcimi protónmi je 2.4 – 4.0 Å.

(-)-(M,R,R)-1 R = *t*-Bu

(-)-(M,R,R)-2 R = H

Obr. Nepriama spin-spinová interakcia medzi dvoma vodíkovými atómami (formálne cez 18 kovalentných väzieb) bola po prvýkrát vôbec pozorovaná experimentálne a potvrdená kvantovochemickým výpočtom.

Publikácia:

DRAČÍNSKÝ, M. - BUCHTA, M. - BUDĚŠÍNSKÝ, M. - VACEK-CHOCHOLOUŠOVÁ, J. - STARÁ, I.G. - STARÝ, I. - MALKINA, O. Dihydrogen contacts observed by through-space indirect NMR coupling. In Chemical Science, 2018, vol. 9, no. 38, p. 7437-7446. (9.063 - IF2017).

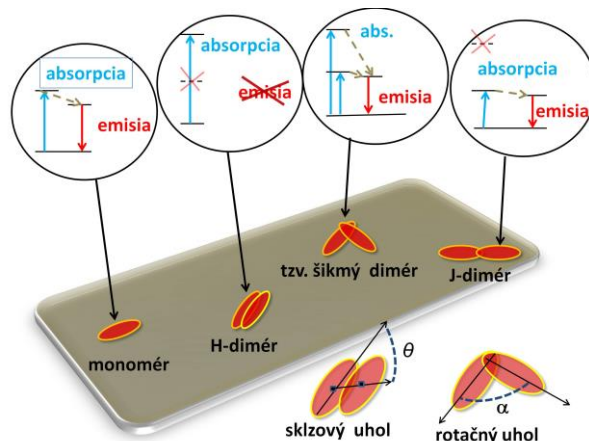
Práca bola editormi vybraná aj ako EDGE ARTICLE na titulnú stránku príslušného čísla časopisu.

**Interakcie organických kationov farbív v sústavách vrstevnatých kremičitanov**

Riešitelia z ÚACH: J. Bujdák, P. Boháč, S. Belušáková

Adsorpcia organických kationov na povrch záporne nabitých častíc je tradičnou témou vedeckého výskumu. V posledných rokoch sa zistilo, že adsorpcia môže byť z hľadiska mechanizmov podstatne komplexnejším javom, ako sa predpokladalo. Pomocou kationov farbív so senzorickými vlastnosťami možno popísať čiastkové deje a v reálnom čase charakterizovať medzimolekulové interakcie adsorbovaných kationov [1]. Po prvom, rýchlom stupni adsorpcie obvykle dochádza k ďalším, časovo rozsiahlym zmenám, ktoré zodpovedajú migrácii, preskupovaniu organických kationov a vzniku rôznych typov molekulových agregátov. Tieto zmeny možno efektívne popísať pomocou fotofyzikálneho javu – metachromatizmu [1]. V

mnohých prípadoch množstvo molekulových agregátov katiónov rastie s povrchovou koncentráciou katiónov [2-4]. Avšak, zistilo sa, že v niektorých prípadoch môže mať povrchová koncentrácia aj opačný efekt [2]. Destabilizácia koloidu a vznik aglomerátov častíc významne ovplyvnili kinetiku migrácie katiónov na povrchu koloidných častíc. Toto viedlo k zníženiu difúzie katiónov a k obmedzeniu vzniku niektorých typov molekulových agregátov [2]. Je zaujímavé, že tieto javy sa nielen selektívne prejavujú v závislosti od molekulovej štruktúry organických katiónov, ale sú významne ovplyvnené aj povrchovými vlastnosťami častíc [3].



Obr. Typy molekulových agregátov farbív na povrchu vrstevnatých častíc a závislosť spektrálnych vlastností agregátov od ich štruktúry.

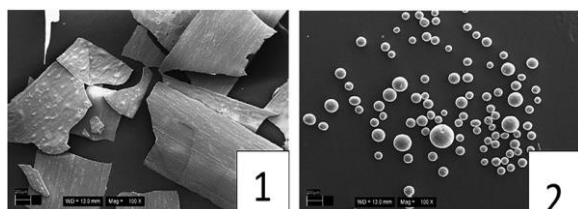
#### Publikácie:

1. **BUJDÁK, J.** The effects of layered nanoparticles and their properties on the molecular aggregation of organic dyes. In *Journal of Photochemistry and Photobiology C: Photochemistry Reviews*, 2018, vol. 35, p. 108-133. (15.325 - IF2017).
2. **BARANYAIOVÁ, T.** - **BUJDÁK, J.** Effects of dye surface concentration on the molecular aggregation of xanthene dye in colloidal dispersions of montmorillonite. In *Clays and Clay Minerals*, 2018, vol. 66, no. 2, p. 114-126. (1.825 - IF2017)
3. **BOHÁČ, P.** - **BUJDÁK, J.** Tuning the photophysical properties of cyanine dyes with clay minerals. In *Clays and Clay Minerals*, 2018, vol. 66, no. 2, p. 127-137. (1.825 - IF2017)
4. **BELUŠÁKOVÁ, S.** - **SOLA-LLANO, R.** - **LOPEZ ARBELOA, I.** - **MARTÍNEZ-MARTÍNEZ, V.** - **BUJDÁK, J.** Resonance energy transfer between dye molecules in hybrid films of a layered silicate, including the effect of dye concentration thereon. In *Applied Clay Science*, 2018, vol. 155, p. 57-64. (3.641 - IF2017)

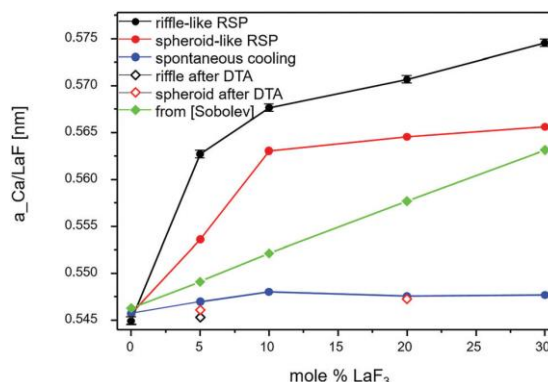
#### Analýza metastabilných fáz v extrémne rýchlo ochladených fluoridových taveninách ( $\text{LiF} - \text{CaF}_2$ )<sub>eut</sub> – $\text{LaF}_3$

Riešitelia z ÚACH: M. Boča, J. Mlynáriková

Metóda extrémne rýchleho chladenia (melt spinning; typicky používaná pre tvorbu kovových skiel) bola prvýkrát aplikovaná na roztavené fluoridy s cieľom zachytenia metastabilných fáz; konkrétne pre systém zloženia  $(\text{LiF} - \text{CaF}_2)_{\text{eut}} - x\text{LaF}_3$  ( $x = 0, 5, 10, 20$ , a  $30 \text{ mol\%}$ ). Touto metódou boli pripravené dva typy podchladených fragmentov – tvaru šupiniek a sférického tvaru (obr. 1). Fázová analýza doplnená o SEM-EDX a S/TEM analýzu potvrdila existenciu metastabilnej fázy obsahujúcej prvky Ca, La a F. Táto fáza súvisí so známou fcc  $\text{Ca}_{0.65}\text{La}_{0.35}\text{F}_{2.35}$  fázou. Mriežkové parametre metastabilnej fázy sa menia so zložením ochladzovaného systému (Obr. 2). Po teplotnej relaxácii sa metastabilná fáza rozpadá na  $\text{CaF}_2$  a  $\text{LaF}_3$ , čo je v súlade s rovnovážnym fázovým diagramom študovaného systému. Pozorovanie tvorby dodatočnej/zdanlivej fázy v nerovnovážnom stave demonštruje využitie extrémne rýchleho chladenia na dosiahnutie a štúdium teplotne nerovnovážnych stavov tuhých látok, čo odráža akýsi zamrznutý stav kvapaliny.



Obr. 1. SEM záznamy podchladených fragmentov systému  $(\text{LiF} - \text{CaF}_2)_{\text{eut}} - (10 \text{ mol\% LaF}_3)$ ;  $\text{Mag.} = 100$   
 (1) – tvar šupiniek  
 (2) – sférický tvar



Obr. 2. mriežkové parametre fcc  $\text{Ca/LaF}$  fázy pripravenej metódou rýchleho chladenia, pripravené spontánnym chladením a po teplotnej relaxácii

#### Publikácia:

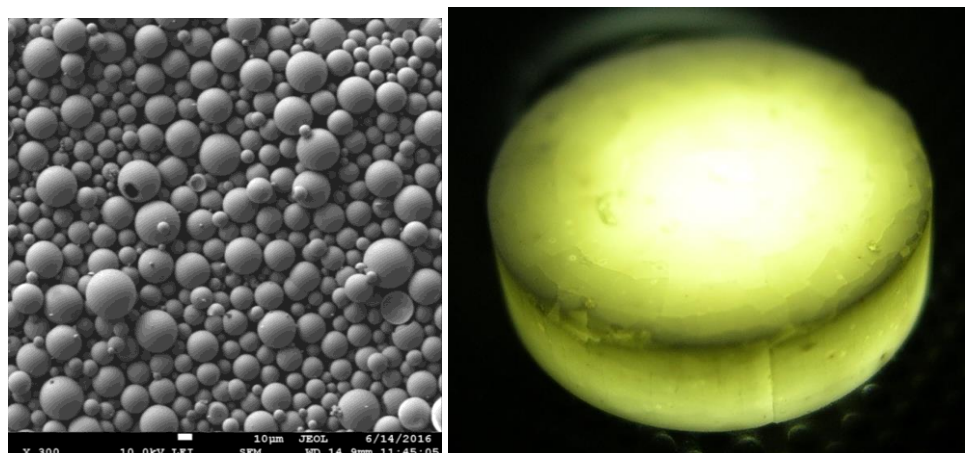
ŠIMURDA, M. - BOČA, M. - ŠVEC, P. - ŠVEC, P. Jr. - JANIČKOVIČ, D. - SHI, Z. - MLYNÁRIKOVÁ, J. Analysis of the extremely rapidly cooled molten system  $(\text{LiF}-\text{CaF}_2)_{\text{eut}}-\text{LaF}_3$ . In New Journal of Chemistry, 2018, vol. 42, p. 4612-4623. (3.201 - IF2017)

### 2.3.2. Aplikčný typ

#### Nízkotepelná príprava translucentnej YAG keramiky žiarovým lisovaním $\text{Y}_3\text{Al}_5\text{O}_{12}$ skla

Riešitelia z ÚACh: M. Micháľková, D. Galusek

Preverili sa možnosti prípravy transparentnej a translucentnej YAG keramiky, pričom sa použil netradičný postup prípravy spekania sklených mikrogulôčok so zložením identickým zloženiu ytrito-hlinitého granátu,  $\text{Y}_3\text{Al}_5\text{O}_{12}$ , žiarovým lisovaním. Pri experimentoch sa využil poznatok, že sklá spekajú viskóznym tokom v teplotnom intervale medzi teplotou skleného prechodu,  $T_G$ , a teplotou začiatku kryštalizácie. Tento interval je, vzhľadom na vysoký sklon ku kryštalizácii ytrito-hlinitanových skiel veľmi úzky (ca 52 °C) a je preto nutná dôkladná optimalizácia podmienok prípravy. Presným nastavením podmienok spekania sa podarilo pripraviť vysoko hutnú (~98 % relatívnej hustoty) a translucentnú kusovú vzorku skla so zložením  $\text{Y}_3\text{Al}_5\text{O}_{12}$  po 1 minúte spekania pri teplote nižšej ako 900 °C a pri aplikácii axiálneho mechanického tlaku 40 MPa. Vysoký sklon ku kryštalizácii pripraveného kusového skla umožňuje rýchlu transformáciu takto pripraveného materiálu na polykryštalický vysoko hutný YAG so submikrónovou veľkosťou zŕn.



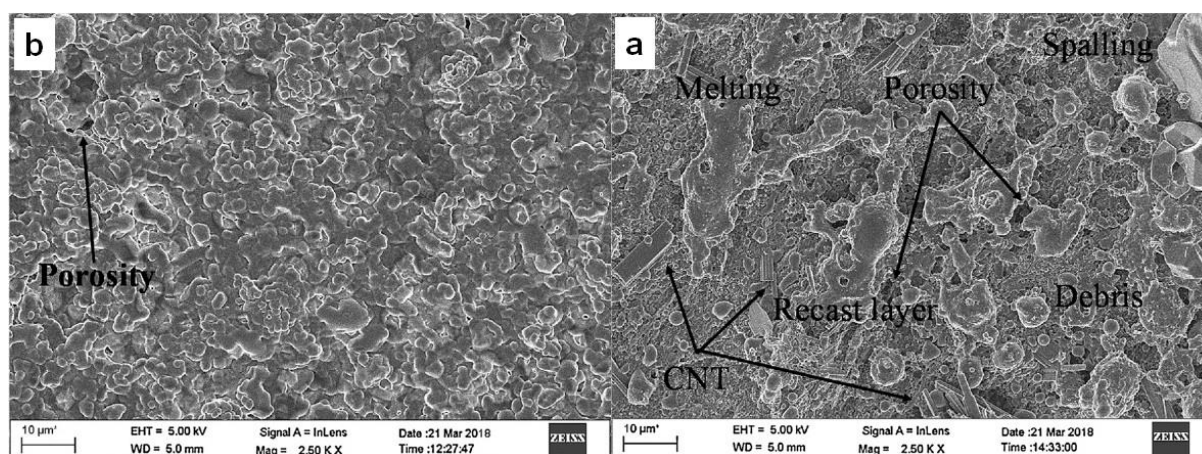
Obr. Žiarovým lisovaním sklených mikrogulôčok so zložením blízkom  $\text{Y}_3\text{Al}_5\text{O}_{12}$  sa podarilo pripraviť translucentnú vzorku skla pri teplote nižšej ako 900°C.

### 2.3.3. Medzinárodné vedecké projekty

#### Elektro-iskrové obrábanie $\text{Al}_2\text{O}_3$ -MWCNT kompozitov

Riešitelia z ÚACh: O. Hanzel, J. Sedláček, P. Šajgalík

V tejto práci boli metódou vymrazovacej granulácie a spekania v rapid hot-pressu pripravené hutné kompozitné materiály s homogénnou distribúciou uhlíkových nanorúrok v  $\text{Al}_2\text{O}_3$  matrici. Na týchto kompozitoch bol študovaný vplyv prídavku uhlíkových nanorúrok na funkčné vlastnosti (elektrická a tepelná vodivosť) a základné charakteristiky elektro-iskrového obrábania. Elektrická vodivosť sa významne zvýšila (o 13 rádov) z hodnoty  $10^{-10}$  S/m (čistý  $\text{Al}_2\text{O}_3$ ) až na hodnotu 1748 S/m pre kompozit s prídavkom 12,5 obj.% CNTs. Toto zvýšenie elektrickej vodivosti umožnilo pripravené materiály obrábať nekonvenčnou metódou akou je elektro-iskrové obrábanie (WEDM – Wire electro-discharge machining). Rýchlosť odoberania materiálu (MRR – material removal rate) sa zvyšovala s rastúcim obsahom MWCNTs, najvyššia hodnota  $\text{MRR} = 11 \text{ mm}^3/\text{min}$  bola dosiahnutá pre kompozit s prídavkom 12,5 obj.% MWCNTs. Navyše, použitím viacnásobného prechodu elektródy v rámci WEDM procesu bolo možné dosiahnuť zníženie drsnosti materiálu po obrobení.



Obr. Zmena drsnosti porchu  $\text{Al}_2\text{O}_3$  keramiky po jedno (a) a päťnásobnom (b) elektro-iskrovom opracovaní.

Publikácie:

SINGH, M.A. – SARMA, D.K. - HANZEL, O. - SEDLÁČEK, J. - ŠAJGALÍK, P. Surface characteristics enhancement of MWCNT alumina composites using multi-pass WEDM process. In Journal of the European Ceramic Society, 2018, vol. 38, p. 4035-4042.

SINGH, M.A. – SARMA, D.K. - HANZEL, O. - SEDLÁČEK, J. - ŠAJGALÍK, P. Surface characteristics and erosion phenomena in WEDM of alumina composites. In Materials and Manufacturing Processes, 2018, vol. 33, p. 1815-1821.

#### Priama príprava transparentného polykryštalického spinelu dopovaného prechodnými kovmi pomocou SPS

Riešiteľ z ÚACh: D. Galusek, H. Abdelrehim

Horečnato-hlinitý spinel  $\text{MgAl}_2\text{O}_4$  spinel je zaujímavým materiálom vhodným pre optické aplikácie, ako sú hostiteľské materiály pre lasery. Keďže spinel má kubickú kryštálovú mriežku, je možné z neho pripraviť transparentný polykryštalický materiál úplnou elimináciou zvyškovej pórovitosti. Vo väčšine prípadov je však na prípravu takéhoto materiálu potrebná pomerne náročná príprava bezdefektného a vysoko hutného surového kompaktu s následnou aplikáciou vysokého tlaku a teploty, napríklad pomocou žiarového izostatického lisovania. V rámci projektu SAS-MOST JRP2015/6 sa vyvinula technológia prípravy vysoko transparentného polykryštalického spinelu jednostupňovou technológiou priameho zhutňovania komerčného spinelového prášku a prášku dopovaného Mn-iónmi pomocou metódy SPS (Obr. 1).



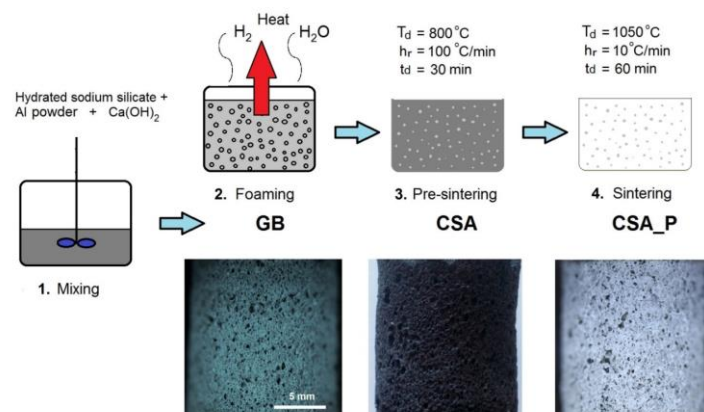


Obr. 1. Vzorky transparentného  $\text{MgAl}_2\text{O}_4$  and Mn-dopovaného  $\text{MgAl}_2\text{O}_4$  pripraveného metódou SPS pri teplote  $1250^\circ\text{C}$  a axiálnom tlaku 80 MPa.

### Vývoj nového, environmentálneho spôsobu prípravy keramických pien na báze $\text{Al}_2\text{O}_3/\text{SiO}_2/\text{CaO}$

Riešitelia z ÚACH: P. Tatarko, O. Hanzel

V tejto práci boli vyvinuté keramické peny na báze  $\text{Al}_2\text{O}_3\text{-SiO}_2\text{-CaO}$  pomocou nového, jednoduchého a nízkonákladového reakčného peniaceho procesu. Zmiešaním práškoveho hliníka a hydroxidu vápenatého vo vodnom roztoku kremičitanu sodného došlo k napneniu vzoriek, ktoré boli následne beztlakovo spekané za asistencie elektrického prúdu pri teplote  $800^\circ\text{C}$  v argónovej atmosfére. Dodatočné tepelné spracovanie bolo realizované na vzduchu pri teplote  $1050^\circ\text{C}$  z dôvodu oxidácie zvyškových kovových fáz. Výsledné keramické peny vykazovali otvorenú pórovitosť, hustotu v rozmedzí od 0,50 do 0,65  $\text{g/cm}^3$  a širokú distribúciu veľkosti pórov (0,04–400  $\mu\text{m}$ ). Pevnosť v tlaku týchto pien sa pohybovala od 2,12 do 1,01 MPa, pričom ich tepelná difuzivita bola na úrovni 0,27 to 0,45  $\text{mm}^2\text{s}^{-1}$ . Tieto vlastnosti potvrdili vhodnosť týchto keramických pien pre využitie ako tepelnoizolačných materiálov.



Obr. 1 Schématická ilustrácia procesu prípravy keramických pien a odpovedajúce makrosnímky po jednotlivých procesných krokoch.

#### Publikácia:

BERTOLLA, L. - CHLUP, Z. - TATARKO, P. - HANZEL, O. - ŠEVEČEK, O. - ROUPCOVÁ, P. - DLOUHÝ, I. Preparation and characterization of novel environmentally friendly  $\text{Al}_2\text{O}_3/\text{SiO}_2/\text{CaO}$  ceramic foams. In *Ceramics International*, 2018, vol. 44, p. 19063-19069. (3.057 - IF2017)

#### Projekty:

Joint Mobility Project within Czech-Slovak scheme for the period 2018–2020 under the ASCR-SAS agreement.  
MVTs UltraCom within the scheme of Support of the Seal of Excellence projects.

**2.4. Publikačná činnosť** (zoznam je uvedený v prílohe C)

Tabuľka 2e Štatistika vybraných kategórií publikácií

<b>PUBLIKAČNÁ A EDIČNÁ ČINNOSŤ</b>	<b>Počet v r. 2018/ doplňky z r. 2017</b>
<b>1. Vedecké monografie a monografické štúdie vydané v domácich vydavateľstvách (AAB, ABB)</b>	0 / 0
<b>2. Vedecké monografie a monografické štúdie vydané v zahraničných vydavateľstvách (AAA, ABA)</b>	0 / 0
<b>3. Odborné monografie, vysokoškolské učebnice a učebné texty vydané v domácich vydavateľstvách (BAB, ACB, CAB)</b>	0 / 0
<b>4. Odborné monografie a vysokoškolské učebnice a učebné texty vydané v zahraničných vydavateľstvách (BAA, ACA, CAA)</b>	0 / 0
<b>5. Kapitoly vo vedeckých monografiách vydaných v domácich vydavateľstvách (ABD)</b>	0 / 0
<b>6. Kapitoly vo vedeckých monografiách vydaných v zahraničných vydavateľstvách (ABC)</b>	0 / 0
<b>7. Kapitoly v odborných monografiách, vysokoškolských učebniciach a učebných textoch vydaných v domácich vydavateľstvách (BBB, ACD)</b>	0 / 0
<b>8. Kapitoly v odborných monografiách, vysokoškolských učebniciach a učebných textoch vydaných v zahraničných vydavateľstvách (BBA, ACC)</b>	0 / 0
<b>9. Vedecké práce registrované v Current Contents Connect (ADCA, ADCB, ADDA, ADDB)</b>	57 / 3
<b>10. Vedecké práce registrované vo Web of Science Core Collection alebo Scopus (ADMA, ADMB, ADNA, ADNB)</b>	4 / 0
<b>11. Vedecké práce v ostatných domácich časopisoch (ADFA, ADFB)</b>	0 / 0
<b>12. Vedecké práce v ostatných zahraničných časopisoch (ADEA, ADEB)</b>	0 / 0
<b>13. Vedecké práce v domácich recenzovaných zborníkoch (AEDA)</b>	0 / 0
<b>14. Vedecké práce v zahraničných recenzovaných zborníkoch (AECA)</b>	0 / 0
<b>15. Publikované príspevky na domácich vedeckých konferenciách (AFB, AFD)</b>	12 / 0
<b>16. Publikované príspevky na zahraničných vedeckých konferenciách (AFA, AFC)</b>	4 / 0
<b>17. Vydané periodiká evidované v CCC, WoS Core Collection, SCOPUS</b>	0
<b>18. Ostatné vydané periodiká</b>	0
<b>19. Zostavovateľské práce knižného charakteru (FAI)</b>	2 / 0
<b>20. Preklady vedeckých a odborných textov (EAJ)</b>	0 / 0
<b>21. Heslá v odborných terminologických slovníkoch a encyklopédiách (BDA, BDB)</b>	0 / 0
<b>22. Recenzie v časopisoch a zborníkoch (EDI)</b>	0 / 0

*Evidujú len tie práce zamestnancov a doktorandov, v ktorých je uvedená afiliácia k organizácii*

Tabuľka 2f Štatistika vedeckých prác podľa kvartilu vedeckého časopisu

<b>Kvartil vedeckého časopisu</b>	<b>Q1</b>	<b>Q2</b>	<b>Q3</b>	<b>Q4</b>	<b>Spolu</b>
<b>Podľa IF z r. 2017 (zdroj JCR)</b>					
Počet článkov / doplnky 2016	31 / 2	22 / 1	2 / 0	1 / 0	56 / 3
<b>Podľa SJR z r. 2017 (zdroj Scimago)</b>					
	46 / 2	9 / 0	3 / 1	0 / 0	58 / 3

*Počet článkov / doplnky 2016*

## Tabuľka 2g Ohlasy

<b>OHLASY</b>	<b>Počet v r. 2017/ doplnky z r. 2016</b>
<b>Citácie vo WOS (1.1, 2.1)</b>	1629 / 18
<b>Citácie v SCOPUS (1.2, 2.2)</b>	7 / 1
<b>Citácie v iných citačných indexoch a databázach (9, 10, 3.2, 4.2)</b>	0 / 0
<b>Citácie v publikáciách neregistrovaných v citačných indexoch (3, 4, 3.1, 4.1)</b>	1 / 1
<b>Recenzie na práce autorov z organizácie (5, 6, 7, 8)</b>	0 / 0

**2.5. Aktívna účasť na vedeckých podujatiach**

## Tabuľka 2h Vedecké podujatia

<b>Prednášky a vývesky na medzinárodných vedeckých podujatiach</b>	51
<b>Prednášky a vývesky na domácich vedeckých podujatiach</b>	34

**2.6. Vyžiadané prednášky****2.6.1. Vyžiadané prednášky na medzinárodných vedeckých podujatiach**

**J. ASHER**, An animated visualization of orbital angular momentum and spin-orbit coupling. Conference „MAGIC-2018“, Kragujevac, Srbsko, 23. – 28. 09. 2018

**J. BUJDÁK**, Resonance energy transfer between dye molecules in the colloids of layered nanoparticles. 11<sup>th</sup> Conference on Colloid Chemistry (Ezsterházy Károly University, Eger, Maďarsko, 27. – 31. 05. 2018

**S. KOMOROVSKÝ**, Recent advances in the calculation of excitation energies in the framework of fully relativistic TDDFT theory. XI<sup>th</sup> Workshop on Modern Methods in Quantum Chemistry, Mariapfarr, Rakúsko, 25. 02. – 02. 03. 2018

**S. KOMOROVSKÝ**, Advances in the calculation of excitation energies in the framework of relativistic four-component TDDFT theory. 7<sup>th</sup> JCS symposium, Praha, Česká republika, 21. – 24. 05. 2018

**S. KOMOROVSKÝ**, Spin-Orbit Heavy Atom on the Light Atom NMR chemical shifts explained. X<sup>th</sup> Symposium nuclear magnetic resonance in chemistry, physics and biological sciences, Varšava, Poľsko, 26. – 28. 09. 2018

**P. ŠAJGALÍK, Z. LENČEŠ**, Role of grain boundary chemistry in silicon nitride based ceramics – Experimental and theoretical approach. 6<sup>th</sup> International Conference on the Characterisation and Control of Interfaces for High Quality Advanced Materials (ICCCI 2018), Kurashiki, Japonsko, 9. – 11. 2018

**Z. LENČEŠ, M. RADWAN, A. CZÍMEROVÁ, R. KLEMENT, P. ŠAJGALÍK, R. RIEDEL**, Polymer precursor derived silicon oxynitrides and transparent spinel ceramics for LED applications. 12<sup>th</sup> International Conference on Ceramic Materials and Components for Energy and Environmental Applications (CMCEE 2018), Singapore, 22. – 26. 07. 2018

**O. MALKIN**, A mystery of a through-space indirect spin-spin coupling between two hydrogen atoms. Conference „Molecules in Extreme Environments, Oslo, Nórsko, 15. – 17. 01. 2018

**O. MALKIN**, A mystery of a through-space indirect spin-spin coupling between two hydrogen atoms. Conference „MAGIC-2018“, Kragujevac, Srbsko, 23. – 28. 09. 2018

**O. MALKIN**, A mystery of a through-space indirect spin-spin coupling between two hydrogen atoms, Conference „INSTRUCT ULTRA“ (2<sup>nd</sup> Structural Biology meeting (within H2020), Bratislava, 15 – 16. 11. 2018

**V. MALKIN**, Visualization of EPR Hyperfine Structure Coupling Pathways. Conference „MAGIC-2018“, Kragujevac, Srbsko, 23. – 28. 09. 2018

**P. ŠAJGALÍK**, Si<sub>3</sub>N<sub>4</sub>-SiC nano-composites sintered with various rare-earth oxide additives for high temperature applications. The Sino-German Symposium, Shangri-la hotel, Xi An, China, 14. – 20. 04. 2018

**P. ŠAJGALÍK**, Miroslav Hnatko, Zoltán Lenčoš, Jan Dusza, Peter Tatarko Alexandra Kovalčíková, Monika Kašiarová, Thermal shock resistance, wear behavior and oxidation resistance of silicon nitride based nano-composites. ICC7, 7th International Congress on Ceramic, Iguassu Falls, Brazília, 17 – 21. 06. 2018



**P. ŠAJGALÍK**, New nitrides and carbides for high temperature application. ICC7, 7th International Congress on Ceramic, Iguassu Falls, Brazilia, 17 – 21. 06. 2018

**P. ŠAJGALÍK**, Electrically conductive ceramics - Processing and properties. In ICACC 2018 - 42<sup>nd</sup> International Conference & Exposition on Advanced Ceramics and Composites, Daytona Beach, Florida, USA, p. 67. 21. – 26. 01. 2018

**P. ŠAJGALÍK**, Electrically conductive ceramics - processing and properties. In ISAC-6. 6th International Symposium on Advanced Ceramics, Katahira Sakura Hall, Tohoku University, Sendai, Japonsko, 12. – 14. 03. 2018

**P. TATARKO**, S. GRASSO, T.G. SAUNDERS, V. CASALEGNO, M. FERRARIS, M.J. REECE, Electric current assisted joining of SiC-based ceramic matrix composites. In ICACC 2018 - 42<sup>nd</sup> International Conference & Exposition on Advanced Ceramics and Composites, Daytona Beach, Florida, USA, p. 35, 21. – 26. 01. 2018

**P. TATARKO**, S. GRASSO, Z. CHLUP, T.G. SAUNDERS, V. CASALEGNO, I. DLOUHÝ, M. FERRARIS, M.J. REECE, Field Assisted Joining of Monolithic CVD-SiC Materials and Ceramic Matrix Composites. In CMCEE-12. 12<sup>th</sup> International Conference on Ceramic Materials and Components for Energy and Environmental Applications, Suntec Convention & Exhibition Centre Singapore, Singapur, 22. – 27. 07. 2018

**P. TATARKO**, S. GRASSO, Z. CHLUP, T.G. SAUNDERS, V. CASALEGNO, I. DLOUHÝ, M. FERRARIS, M.J. REECE, Electric current assisted solid-state diffusion bonding of SiC and CMCs. In 1<sup>st</sup> International Workshop on Advanced SiC-based Ceramic Processing and Joining, Ningbo Institute of Materials Technology and Engineering (NIMTE), Chinese Academy of Sciences, Ningbo, Čína, 27. 06. 2018

## 2.6.2. Vyžiadané prednášky na domácich vedeckých podujatiach

**J. BUJDÁK**, Hybrid materials based on layered nanoparticles and photoactive organic dyes, Univerzita J. Selyeho, Komárno, Slovensko, 5. 11. 2018

**J. BUJDÁK**, Využitie chemometrie pre spracovanie dát v prírodných vedách. Čo nového v mikrobiológii? Mikulášska chata, Demänovská dolina, Nízke Tatry, 14. – 18. 03. 2018

**S. KOMOROVSKÝ**, Simple trick in the MO analysis of spectroscopic properties. GOLDCAT workshop, Smolenice, Slovensko, 22. – 24. 11. 2018

## 2.6.3. Vyžiadané prednášky na významných vedeckých inštitúciách

**T. BUČKO**, On the origin of the difference between type A and type B skeletal isomerization of C7 alkenes: an ab initio MD study, Karlsruhe Institute of Technology, Karlsruhe, Nemecko, 19. 11. 2018

**J. BUJDÁK**, Resonance energy transfer and other photophysical phenomena occurring in the hybrid systems of layered silicates and organic dyes, National Institute for Materials Science, Tsukuba, Japonsko, 08. 06. 2018

**M. KORENKO**, Solar thermal production of Mg from MgO, Institute of High Temperature Physics, Chinese Academy of Sciences, Peking, Čína, 06. 07. 2018

**O. MALKIN**, A mystery of a through-space indirect spin-spin coupling between two hydrogen atoms. The Paris Lodron University of Salzburg, Rakúsko, 7. 09. 2018

**V. PAVLÍK**, M. BOČA, Electrochemical investigation of the molten systems containing rare earth metals. Tananaev Institute of Chemistry and Technology of Rare Elements and Mineral Raw Materials, Kola Science Centre of the Russian Academy of Sciences, Apatity, Rusko, 26. 09. 2018

**V. PAVLÍK**, M. BOČA, Physico-chemical and electrochemical properties of a new type of ionic liquids – deep eutectic solvents, Ukrainian State University of Chemical Technology, Dnipro, Ukrajina, 09. 10. 2018

**P. ŠAJGALÍK**, Silicon nitride based ceramics – fantastic diversity of their application, Northwestern Polytechnic University, Xi An, Čína, 19. 11. 2018

**P. TATARKO**, Mechanical properties of ceramics, Ningbo Institute of Materials Technology and Engineering (NIMTE), Chinese Academy of Sciences, Ningbo, Čína, 29. 06. 2018

*Ak boli príspevky publikované, sú súčasťou prílohy C, kategória (AFC, AFD, AFE, AFF, AFG, AFH)*

## 2.7. Patentová a licenčná činnosť na Slovensku a v zahraničí v roku 2018

### 2.7.1. Vynálezy, na ktoré bol udelený patent

### 2.7.2. Prihlásené vynálezy

### 2.7.3. Predané licencie

### 2.7.4. Realizované patenty

*Finančný prínos pre organizáciu SAV v roku 2018 a súčet za predošlé roky sa neuvádzajú, ak je zverejnenie v rozpore so zmluvou súvisiacou s realizáciou patentu.*

## 2.8. Účasť expertov na hodnotení národných projektov (APVV, VEGA a iných)

Tabuľka 2i Experti hodnotiaci národné projekty

Meno pracovníka	Typ programu/projektu/výzvy	Počet hodnotených projektov
Galusek Dušan	VEGA	1
Hnatko Miroslav	APVV	1
Jankovič Ľuboš	APVV	3
	VEGA	1
Komorovský Stanislav	VEGA	1
Korenko Michal	APVV (všeobecná výzva 2017)	2
Lenčes Zoltán	VEGA	5
Šimko František	VEGA	1

## 2.9. Účasť na spracovaní hesiel do encyklopédie Beliana

Počet autorov hesiel: 0

## 2.10. Recenzovanie publikácií a príspevkov vo vedeckých časopisoch

Tabuľka 2j Počet recenzovaných monografií, článkov, zborníkov

Meno pracovníka	Knížné monografie		Príspevky v časopisoch			Zborníky	
	Domáce	Zahra-ničné	WoS, SCOPUS	Iné databázy	Ostatné	Domáce	Zahra-ničné
Boča Miroslav	0	0	4	0	0	0	0
Bujdák Juraj	0	0	5	1	0	0	0
Galusek Dušan	0	0	9	0	0	0	0
Hnatko Miroslav	0	0	0	0	0	1	0
Jankovič Ľuboš	0	0	12	0	0	0	0
Kubíková Blanka	0	0	2	0	0	0	0
Lenčes Zoltán	0	0	4	0	0	0	0

Madejová Jana	0	0	7	0	0	0	0
Malkin Oľga	0	0	7	0	0	0	0
Páľková Helena	0	0	1	0	0	0	0
Pavlík Viliam	0	0	3	0	0	0	0
Scholtzová Eva	0	0	9	0	0	0	0
Tatarko Peter	0	0	26	0	0	3	0
<b>Spolu</b>	<b>0</b>	<b>0</b>	<b>89</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>0</b>

## 2.11. Iné informácie k vedeckej činnosti.

Počet časopiseckých karentovaných publikácií registrovaných v databáze WOS a SCOPUS v roku 2018 dosiahol číslo 58. V závislosti na metodike, na ktorú kategóriu sa vzťahuje prepočítaný podiel publikácie, je možné uvažovať o kategóriách: vedeckí pracovníci, ostatní vedeckí pracovníci s VŠ vzdelaním, ostatní pracovníci zapojení do riešenia projektov a doktorandi. Vzhľadom na to, že nie je k dispozícii jednoznačné usmernenie, budeme vychádzať z usmernenia poslednej akreditácie, kedy sa počet publikačných výstupov vzťahoval na počet zamestnancov s univerzitným titulom zapojených do výskumných projektov 45,01, vrátane ôsmich doktorandov (šiestich s plnou kapacitou, dvaja s kapacitou 0,25), ktorí k 31.12. vystupovali v riešiteľských kolektívoch 51,51. Potom na jedného pracovníka pripadá 1,33 karentovanej publikácie, vrátane doktorandov – 1,16 publikácie.

Takýto stav považujeme stále za zlepšiteľný a cieľom ostáva dosiahnuť dve publikácie na vedeckého pracovníka ročne, ktorý zodpovedá štandardu vyspelých vedeckých pracovísk s podobným zameraním. Priemerný impakt faktor časopisov, v ktorých boli práce uverejnené, bol 3,41, pokiaľ vlni to bolo 2,83 (treba mať na pamäti, že údaje sú zo záverečných správ, v ktorých sa nachádzajú aj doplnky publikácií za predchádzajúci rok 2017, ktorým ešte neboli priradené kompletne bibliografické údaje v čase spracovávania podkladov do záverečných správ). V roku 2018, bolo publikovaných päť vedeckých prác v časopisoch zaradených do zoznamu Nature Index. Na základe uznesenia Predsedníctva SAV, bola týmto autorom, ktorí sa podieľali na vybraných publikáciách udelená finančná odmena. Ohodnotené práce zaradené v Nature Index:

- CHALMERS, B. - NEJMAN, P.S. - LLEWELLYN, A.V. - FELAAR, A.M. - GRIFFITHS, B.L. - PORTMAN, E.I. - GORDON, E.J.L. - FAN, K.J.H. - WOOLINS, J.D. - BÜHL, M. - MALKINA, O. - CORDES, D.B. - SLAWIN, A.M.Z. - KILIAN, P. In Inorganic Chemistry, 2018, vol. 57, no. 6, 3387-3398;
- JEREMIAS, L. - NOVOTNÝ, J. - REPISKÝ, M. - KOMOROVSKÝ, S. - MAREK, R. Inorganic Chemistry, 2018, vol. 57, p. 8748-8759;
- NOVOTNÝ, J. - PŘICHYSTAL, D. - SOJKA, M. - KOMOROVSKÝ, S. - NEČAS, M. - MAREK, R. Inorganic Chemistry, 2018, vol. 57, p. 641-652;
- RAKHMATULLIN, A. - POLOVOV, I.B. - MALTSEV, D. - ALLIX, M. - VOLKOVICH, V. - CHUKIN, A.V. - BOČA, M. - BESSADA, C. Inorganic Chemistry, 2018, vol. 57, p. 1184-1195;
- ŠIMKO, F. - RAKHMATULLIN, A. - VERON, E. - ALLIX, M. - FLORIAN, P. - KONTRÍK, M. - NETRIOVÁ, Z. - KORENKO, M. - KAVEČANSKÝ, V. - BESSADA, C. Inorganic Chemistry, 2018, vol. 57, p. 13702-13712).

Citovanosť (vo všetkých dostupných databázach WOS – 1647, SCOPUS – 8) na vedeckého pracovníka (39,43) je 41,97 citácií, čo predstavuje nárast v porovnaní s rokom 2017. Pracovníci ústavu predniesli 19 pozvaných prednášok na významných svetových konferenciách.

### 3. Doktorandské štúdium, iná pedagogická činnosť a budovanie ľudských zdrojov pre vedu a techniku

#### 3.1. Údaje o doktorandskom štúdiu

Tabuľka 3a Počet doktorandov v roku 2018

Forma	Počet k 31.12.2018						Počet ukončených doktorantúr v r. 2018					
	Doktorandi						Ukončenie z dôvodov					
	celkový počet		z toho novoprijatí		po skúške		ukončenie úspešnou obhajobou		predčasné ukončenie		neúspešné ukončenie	
	M	Ž	M	Ž	M	Ž	M	Ž	M	Ž	M	Ž
<b>Denná zo zdrojov SAV</b>	6	2	1	1	2	0	1	0	0	0	0	0
<b>Denná z iných zdrojov</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Externá</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>Spolu</b>	6	2	1	1	2	0	1	0	0	0	0	0
<b>Súhrn</b>	8		2		2		1		0		0	

*Uvádzajte len doktorandov organizácie ako externej vzdelávacej inštitúcie*

#### 3.2. Zmena formy doktorandského štúdia

Tabuľka 3b Počty preradení z dennej formy na externú a z externej na dennú

Pôvodná forma	Denná z prostriedkov SAV	Denná z prostriedkov SAV	Denná z iných zdrojov	Denná z iných zdrojov	Externá	Externá
Nová forma	Denná z iných zdrojov	Externá	Denná z prostriedkov SAV	Externá	Denná z prostriedkov SAV	Denná z iných zdrojov
<b>Počet</b>	0	0	0	0	0	0

#### 3.3. Zoznam doktorandov, ktorí ukončili doktorandské štúdium úspešnou obhajobou

Tabuľka 3c Menný zoznam ukončených doktorandov v roku 2018 úspešnou obhajobou

Meno doktoranda	Forma DŠ	Mesiac, rok nástupu na DŠ	Mesiac, rok obhajoby	Číslo a názov študijného odboru	Meno a organizácia školiteľa	Fakulta udeľujúca vedeckú hodnotu
Mgr. Michal Vetrecin	interné štúdium hradené z prostriedkov SAV	9 / 2010	8 / 2018	4.1.15 anorganická chémia	prof. RNDr. Pavol Šajgalík DrSc., Ústav anorganickej chémie SAV	Prírodovedecká fakulta UK

*Zoznam interných a externých doktorandov je uvedený v prílohe A.*

### 3.4. Medzinárodné doktorandské štúdium

Tabuľka 3d Počet študentov v medzinárodných programoch doktorandského štúdia

Cotutelle	Co-direction	Iné	Zahraniční doktorandi
0	0	0	2

### 3.5. Zoznam akreditovaných študijných odborov s uvedením VŠ

Tabuľka 3e Zoznam akreditovaných študijných odborov s uvedením univerzity/vysokej školy a fakulty, kde sa doktorandský študijný program uskutočňuje

Názov študijného odboru (ŠO)	Číslo ŠO	Doktorandské štúdium uskutočňované na (univerzita/vysoká škola a fakulta)
chemická fyzika	4.1.11	
anorganická chémia	4.1.15	Prírodovedecká fakulta UK
anorganická chémia	4.1.15	Univerzita Komenského v Bratislave
anorganická technológia a materiály	5.2.19	Fakulta chemickej a potravinárskej technológie STU
anorganická technológia a materiály	5.2.19	Slovenská technická univerzita v Bratislave

Tabuľka 3f Účasť na pedagogickom procese

Menný prehľad pracovníkov, ktorí boli menovaní do spoločných odborových komisií pre doktorandské štúdium	Menný prehľad pracovníkov, ktorí pôsobili ako členovia vedeckých rád univerzít, správnych rád univerzít a fakúlt	Menný prehľad pracovníkov, ktorí získali vyššiu vedeckú, pedagogickú hodnotu alebo vyšší kvalifikačný stupeň
doc. Ing. Miroslav Boča, DrSc. (anorganická chémia)	doc. Ing. Miroslav Boča, DrSc. (Trenčianska univerzita Alexandra Dubčeka v Trenčíne)	Ing. Monika Micháľková, PhD. (IIa)
doc. Ing. Miroslav Boča, DrSc. (anorganická technológia a materiály)	prof. Ing. Dušan Galusek, DrSc. (Fakulta špeciálnej techniky TnUAD)	prof. RNDr. Juraj Bujdák, DrSc. (prof., Univerzita Komenského v Bratislave)
prof. RNDr. Juraj Bujdák, DrSc. (anorganická chémia)	prof. Ing. Dušan Galusek, DrSc. (Fakulta zdravotníctva TnUAD)	
prof. RNDr. Juraj Bujdák, DrSc. (fyzikálna chémia)	prof. Ing. Dušan Galusek, DrSc. (Trenčianska univerzita Alexandra Dubčeka v Trenčíne)	
prof. Ing. Dušan Galusek, DrSc. (anorganická technológia a materiály)	prof. Ing. Marek Liška, DrSc. (Fakulta chemické technológie VŠCHT, Praha, ČR)	
doc. Ing. Miroslav Hnatko, PhD. (anorganická technológia a materiály)	prof. Ing. Marek Liška, DrSc. (Trenčianska univerzita Alexandra Dubčeka v Trenčíne)	
RNDr. Peter Komadel, DrSc. (anorganická chémia)	prof. RNDr. Jozef Noga, DrSc. (Fakulta prírodných vied UMB)	
doc. Ing. Zoltán Lenčes, PhD. (anorganická technológia a materiály)	prof. RNDr. Jozef Noga, DrSc. (Prírodovedecká fakulta UK)	
doc. Ing. Zoltán Lenčes, PhD. (anorganická chémia)	prof. RNDr. Pavol Šajgalík, DrSc. (Fakulta metalurgie a materiálového inžinierstva, Vysoká škola báňská	

TU)	
doc. Ing. Zoltán Lenčes, PhD. (odbor v zahraničí)	prof. RNDr. Pavol Šajgalík, DrSc. (Hutnícka fakulta TUKE)
prof. Ing. Marek Liška, DrSc. (anorganická technológia a materiály)	prof. RNDr. Pavol Šajgalík, DrSc. (Slovenská technická univerzita v Bratislave)
prof. Ing. Marek Liška, DrSc. (fyzika kondenzovaných látok a akustika)	prof. RNDr. Pavol Šajgalík, DrSc. (Trenčianska univerzita Alexandra Dubčeka v Trenčíne)
RNDr. Jana Madejová, DrSc. (anorganická technológia a materiály)	prof. RNDr. Pavol Šajgalík, DrSc. (Univerzita Komenského v Bratislave)
Dr. Oľga Malkin, DrSc. (teoretická a počítačová chémia)	prof. RNDr. Pavol Šajgalík, DrSc. (Univerzita Pavla Jozefa Šafárika v Košiciach)
Dr. Vladimír Malkin, DrSc. (chemická fyzika)	prof. RNDr. Pavol Šajgalík, DrSc. (Univerzita sv. Cyrila a Metoda v Trnave)
Dr. Vladimír Malkin, DrSc. (teoretická a počítačová chémia)	prof. RNDr. Pavol Šajgalík, DrSc. (Vysoké učení technické, Brno)
prof. RNDr. Jozef Noga, DrSc. (chemická fyzika)	
prof. RNDr. Jozef Noga, DrSc. (anorganická chémia)	
prof. RNDr. Jozef Noga, DrSc. (fyzika plazmy)	

### 3.6. Údaje o pedagogickej činnosti

Tabuľka 3g Prednášky a cvičenia vedené v roku 2018

PEDAGOGICKÁ ČINNOSŤ	Prednášky		Cvičenia a semináre	
	doma	v zahraničí	doma	v zahraničí
Počet prednášateľov alebo vedúcich cvičení	4	1	8	0
Celkový počet hodín v r. 2018	60	3	231	0

*Prehľad prednášateľov predmetov a vedúcich cvičení, s uvedením názvu predmetu, úväzku, katedry, fakulty, univerzity/vysokej školy je uvedený v prílohe D.*

Tabuľka 3h Aktivity pracovníkov na VŠ

1.	Počet pracovníkov, ktorí pôsobili ako vedúci alebo konzultanti diplomových a bakalárskych prác	4
2.	Počet vedených alebo konzultovaných diplomových a bakalárskych prác	4
3.	Počet pracovníkov, ktorí pôsobili ako školitelia doktorandov (PhD.)	9
4.	Počet školených doktorandov (aj pre iné inštitúcie)	26
5.	Počet oponovaných dizertačných a habilitačných prác	17
6.	Počet pracovníkov, ktorí oponovali dizertačné a habilitačné práce	6
7.	Počet pracovníkov, ktorí pôsobili ako členovia komisií pre obhajoby DrSc. prác	1

<b>8.</b>	<b>Počet pracovníkov, ktorí pôsobili ako členovia komisií pre obhajoby PhD. prác</b>	<b>7</b>
<b>9.</b>	<b>Počet pracovníkov, ktorí pôsobili ako členovia komisií, resp. oponenti v inauguračnom alebo habilitačnom konaní na vysokých školách</b>	<b>3</b>

### 3.7. Iné dôležité informácie k pedagogickej činnosti

ÚACh SAV vypísal pre akademický rok 2018/2019 celkovo 15 tém pre doktorandské štúdium vo všetkých akreditovaných odboroch: 4.1.15 Anorganická chémia, 5.2.19 Anorganické technológie a materiály a 4.1.11 Chemická fyzika. Po úspešnom prijímacom konaní nastúpili dvaja noví študenti na internú formu doktorandského štúdia v študijnom odbore 4.1.15 Anorganická chémia na PriF UK.

V akademickom roku 2017/2018 obhájil dizertačnú prácu Mgr. Michal Vetrecin v študijnom odbore 4.1.15 Anorganická chémia (denná forma)

PhD študenti na ÚACh SAV sa pravidelne zúčastňujú na študentských vedeckých podujatiach a konferenciách, akými sú napr. ŠVK FCHPT STU 2018.

Dňa 18.10.2018 sa na ÚACh SAV konala Súťaž mladých vedeckých pracovníkov do 35 rokov za účasti 13 mladých vedeckých pracovníkov z ÚACh SAV Bratislava, TnU AD Trenčín a z ÚACh AV ČR. Na prvých troch miestach sa umiestnili:

1. Mgr. Silvia Belušáková, PhD. (ÚACh SAV)
2. Ing. Ivana Petříková, PhD. (TnU AD Trenčín)
3. Ing. Daniel Bůžek (ÚACh AV ČR)

Doc. Ing. Zoltán Lenčేశ, PhD. a doc. Ing. Miroslav Hnatko, PhD. pôsobili v roku 2018 ako školitelia-špecialisti troch zahraničných doktorandiek (Dipl.-Ing. Christina Atzenhofer, Dipl.-Ing. Anastasia Kucheryavaya a Ing. Taťána Fenclová), ktoré si v rámci vzájomnej spolupráce s Montanuniversität Leoben, Austria, resp. VŠB-Technická univerzita Ostrava, realizovali časť svojich PhD. prác na ÚACh SAV.

## 4. Medzinárodná vedecká spolupráca

### 4.1. Medzinárodné vedecké podujatia

#### 4.1.1. Medzinárodné vedecké podujatia, ktoré organizácia SAV organizovala v roku 2018 alebo sa na ich organizácii podieľala, s vyhodnotením vedeckého a spoločenského prínosu podujatia

**11<sup>th</sup> Workshop on Modern Methods in Quantum Chemistry**, Mariapfarr, Rakúsko, 47 účastníkov, 25.02.-02.03.2018

Počas podujatia odznelo 25 prednášok. Účastníci - Nórsko, Česká republika, Nemecko, Fínsko, Dánsko, Slovensko.

**5<sup>th</sup> Workshop of Slovak Clay Group Clay minerals and selected non-raw materials in material science, industrial applications and environmental technology**, Banská Štiavnica, Slovensko, 27 účastníkov, 21.05.-23.05.2018

**9. odborný seminár Interakcie tavenín s progresívnymi anorganickými materiálmi**, Borinka, Slovensko, 24 účastníkov, 15.10.-16.10.2018

Odborný seminár vedeckých pracovníkov 4 inštitúcií (ÚACH SAV Bratislava, FCHPT STU Bratislava, TUKE Košice a VŠB-TUO Ostrava, ČR) s cieľom prezentácie aktuálnych vedeckých výsledkov. Odznelo 11 prednášok.

#### 4.1.2. Medzinárodné vedecké podujatia, ktoré usporiada organizácia SAV v roku 2019 (anglický a slovenský názov podujatia, miesto a termín konania, meno, telefónne číslo a e-mail zodpovedného pracovníka)

**Engineering Ceramics 2019 – Ceramics for People**, Smolenice, Slovensko, 86 účastníkov, 12.05.-16.05.2019, (Zoltán Lenčoš, 02/59410408, uachlenc@savba.sk)

#### 4.1.3. Počet pracovníkov v programových a organizačných výboroch medzinárodných konferencií

Tabuľka 4a Programové a organizačné výbory medzinárodných konferencií

Meno pracovníka	Programový	Organizačný	Programový i organizačný
Boča Miroslav	0	0	1
Bujdák Juraj	2	0	0
Kubíková Blanka	0	0	1
Kureková Valéria	0	1	0
Madejová Jana	1	0	1
Pálková Helena	0	0	1
Šajgalík Pavol	3	0	1
Šimko František	0	0	1
<b>Spolu</b>	<b>6</b>	<b>1</b>	<b>6</b>

### 4.2. Členstvo a funkcie v medzinárodných orgánoch

#### 4.2.1. Členstvo a funkcie v medzinárodných vedeckých spoločnostiach, úniách a národných komitétach SR

Mgr. Silvia Belušáková, PhD.

AIPEA - International Association for the study of Clays (funkcia: člen)

doc. Ing. Miroslav Boča, DrSc.



European Technology Platform for Advanced Engineering Materials and Technologies (funkcia: člen správnej rady EuMat)

Mgr. Peter Boháč, PhD.

AIPEA - International Association for the study of Clays (funkcia: člen)

prof. RNDr. Juraj Bujdák, DrSc.

AIPEA - International Association for the study of Clays (funkcia: člen)

Mgr. Adriana Czímerová, PhD.

AIPEA - International Association for the study of Clays (funkcia: člen)

prof. Ing. Dušan Galusek, DrSc.

American Ceramic Society (funkcia: člen)

European Society on Glass Science and Technology (funkcia: člen)

Mgr. Ľuboš Jankovič, PhD.

AIPEA - International Association for the study of Clays (funkcia: člen)

RNDr. Peter Komadel, DrSc.

AIPEA - International Association for the study of Clays (funkcia: člen)

The Clay Minerals Society (funkcia: člen)

Ing. Michal Korenko, PhD.

International Union of Pure and Applied Chemistry (IUPAC) (funkcia: National Representative (NR) of Division I)

Mgr. Valéria Kureková, PhD.

AIPEA - International Association for the study of Clays (funkcia: člen)

doc. Ing. Zoltán Lenčič, PhD.

American Ceramic Society (funkcia: člen)

Ceramic Society of Japan (funkcia: člen)

European Ceramic Society (funkcia: člen výboru)

International Ceramic Federation (funkcia: člen)

Materials Research Society (funkcia: člen)

RNDr. Jana Madejová, DrSc.

AIPEA - International Association for the study of Clays (funkcia: člen výboru)

The Clay Minerals Society (funkcia: člen)

Dr. Vladimír Malkin, DrSc.

WATOC - World Association of Theoretical and Computational Chemists (funkcia: člen)

Daniel Moreno

AIPEA - International Association for the study of Clays (funkcia: člen)

prof. RNDr. Jozef Noga, DrSc.

International Academy of Quantum Molecular Sciences (funkcia: volený člen)

World Association of Theoretical and Computational Chemists (funkcia: člen)

Ing. Helena Pálková, PhD.

AIPEA - International Association for the study of Clays (funkcia: člen)

Clay Mineral Society (funkcia: člen)

Ing. Anna Prnová, PhD.

Slovak Fulbright Alumni Association (funkcia: člen)

Ing. Eva Scholtzová, CSc.

AIPEA - International Association for the study of Clays (funkcia: člen)

Ing. Michal Slaný

AIPEA - International Association for the study of Clays (funkcia: člen)

prof. RNDr. Pavol Šajgalík, DrSc.

American Ceramic Society (funkcia: člen)

Ceramic Society of Japan (funkcia: člen)

Council of the European Ceramic Society (funkcia: člen)

European Ceramic Society (funkcia: prezident)

International Ceramic Federation (funkcia: člen predstavenstva)

Materials Research Society (funkcia: člen)

Permanent Executive Committee ECerS (funkcia: volený člen)

World Academy of Ceramics (funkcia: volený člen)

Ing. Peter Škorňa, PhD.

AIPEA - International Association for the study of Clays (funkcia: člen)

**4.3. Účast' expertov na hodnotení medzinárodných projektov (EÚ RP, ESF a iných)**

Tabuľka 4b Experti hodnotiaci medzinárodné projekty

Meno pracovníka	Typ programu/projektu/výzvy	Počet hodnotených projektov
Šajgalík Pavol	Alexander von Humboldt Foundation – Sofja	1
	Kovalevskaja Award	1
	ERC-2018-STG	1
Tatarko Peter	APVV VV, APVV SK-SRB, SK-PT, SK-PL	5
	Banting Postdoctoral Fellowship (Canada)	1

**4.4. Najvýznamnejšie prínosy MVTS ústavu vyplývajúce z mobility a riešenia medzinárodných projektov a iné informácie k medzinárodnej vedeckej spolupráci****Mária Chromčíková**

- Pobyť na Univerzite v Gente v Belgicku bola zameraná na prípravu tenkých vrstiev metódou „deep coating“. Ako substrát boli použité mikroskopické podložné sklíčka a na prípravu tenkých vrstiev sa použil roztok SiO<sub>2</sub> pripravený na Slovensku. Vzorky boli pripravované s cieľom lepšieho oboznámenia sa s touto technikou, nakoľko sa tejto metóde chceme v blízkom čase venovať aj v laboratóriách na Slovensku.

**Michal Korenko**

- Institute of High Temperature Physics, Chinese Academy of Sciences, Peking, Čína (02. – 14 .07. 2018). Medziakademická spolupráca (MAD) medzi ÚACh SAV a ústavom čínskej AV. Pobyť zameraný na vzájomnú spoluprácu v oblasti elektrochemických separačných technológií. Dňa 06.07.2018 prednáška s názvom “Solar thermal production of Mg from MgO”.
- Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA (02. – 05.10.2018). Predstavenie našich aktivít v oblasti taveninovej chémie a elektrochémie v súvislosti s konceptom taveninových jadrových reaktorov.

**Valéria Kureková**

- 8. – 19. 11. 2018, Krakow, Poľsko - Pobyť sa uskutočnil v rámci spolupráce Ústavu anorganickej chémie SAV a Ústavu katalýzy a fyzikálnej chémie povrchov J. Habera, Poľskej akadémie vied v Krakove. Tieto dve inštitúcie spolu participujú na projekte „Organo-clays as intermediates for the synthesis of functional hybrid materials”.

**Helena Pálková**

- Jerzy Haber Institute of Catalysis and Surface Chemistry PAS, Krakow, Poľsko (8. – 19. 11. 2018)

Spoločný projekt „Organo-clays as intermediates for the synthesis of functional hybrid materials”. Medziakademická spolupráca (MAD) medzi Ústavom anorganickej chémie SAV a ústavom PAV.

#### **Viliam Pavlík**

- Tananaev Institute of Chemistry and Technology of Rare Elements and Mineral Raw Materials, Kola Science Centre of the Russian Academy of Sciences, Apatity, Rusko (16. – 29. 09. 2018). Výskumný pobyt na základe kooperačného protokolu medzi ÚACh SAV a TIC FRC KSC RAS zameraný na skúmanie roztavených systémov pri 1000 °C obsahujúcich vzácne kovy pomocou elektrochemických metód. Dňa 26.09.2018 prednáška s názvom “Electrochemical investigation of the molten systems containing rare earth metals”.
- Research Institute of Galvanotechnology, Ukrainian State University of Chemical Technology, Dnipro, Ukrajina (30. 09. – 14. 10. 2018). Výskumný pobyt na základe kooperačného protokolu medzi ÚACh SAV a RIG USUCHT zameraný na skúmanie elektrodepozície použitím nízkoeutektických roztokov obsahujúcich kation kovu pomocou elektrochemických metód. Dňa 09. 10. 2018 prednáška s názvom “Physico-chemical and electrochemical properties of a new type of ionic liquids – deep eutectic solvents”.

#### **Anna Prnová**

- Department of Inorganic and Physical Chemistry, Gent University, Belgicko, 15. - 29. 2018, príprava roztokov v systéme  $\text{Al}_2\text{O}_3\text{-Y}_2\text{O}_3$  pre plameňovú syntézu, účasť na konferencii ISIEM 2018.

#### **Peter Tatarko**

- Ningbo Institute of Materials Technology and Engineering (NIMTE), Chinese Academy of Sciences, Ningbo, China (25.06 – 02.07.2018). Spoločný projekt APVV-SK-CN-0040 „Spájanie moderných keramických materiálov na báze SiC”. Počas návštevy 2 vyzvané prednášky: 1. TATARKO, P. - GRASSO, S. – CHLUP, Z. – SAUNDERS, T.G. - CASALEGNO, V. – DLOUHÝ, I. – FERRARIS, M. - REECE, M.J. Electric current assisted solid-state diffusion bonding of SiC and CMCs. In 1st International workshop on advanced SiC-based ceramic processing and joining, june 27, 2018; 2. TATARKO, Peter: Mechanical properties of ceramics, june 29, 2018.
- Ústav fyziky materiálov, AVČR, Brno, Česká republika (8.10-11.10.2018 a 13.11-14.11.2018). Spoločný projekt, medziakademická spolupráca MAD SAV-AVČR-18-12 „Vývoj nových pokročilých keramických kompozitov pre vesmírne aplikácie“.

### **Dlhodobé pobyty na zahraničných inštitúciách (viac ako 3 mesiace)**

#### **Peter Boháč**

- Karlsruhe Institute of Technology. Nemecko, Sandwich VP project, 01/11/2017 - 06/06/2019. Projekt sa zaoberá štúdiom bariér pre podzemné úložiská rádioaktívneho odpadu.

#### **Stanislav Kedžuch**

- Kobe University, Kobe, Japonsko, (16.12.2017-15.3.2018). Pobyt sa uskutočnil na základe pozvania japonskej strany. Náplňou bol vývoj explicitne korelovanej metódy ring-CCD-F12 s plným zahrnutím trojelektrónových integrálov, ktorá je použiteľná pre reálne chemické aplikácie.

### **Prednášky zahraničných hostí na ÚACh SAV v roku 2018**

**prof. Masataka Nagaoka**, Graduate School of Informatics, Nagoya University, Nagaya, Japonsko

**28.05.2018** - A computational chemical study based on red moon methodology:

Microscopic additive effect on SEI film formation in sodium-ion batteries

**prof. Shigeyoshi Sakaki**, Fukui Institute for Fundamental Chemistry, Kyoto University, Japonsko

**28.05.2018** - Theoretical approach to solid systems such as molecular crystal, MOFs

and metal oxide surface

**prof. Chengyu Zhang**, Northwestern Polytechnical University, Xi'an, Shaanxi, Čína

**18.09.2018** - Si-B-C-N matrix/interfaces in SiC-based composites prepared by CVD/CVI

**Dr. Michael Patzschke**, Helmholtz-Zentrum Dresden Rossendorf, Institute for Resource Ecology, Nemecko

**08.11.2018** - Computational Chemistry for Nuclear Waste Disposal

*Prehľad údajov o medzinárodnej mobilité pracovníkov organizácie je uvedený v Prílohe E.*

*Prehľad a údaje o medzinárodných projektoch sú uvedené v kapitole 2 a Prílohe B.*

## 5. Vedná politika

Vedná politika ústavu reflektuje dlhodobé zámery a aktuálne trendy súvisiace so spoločenskou objednávkou na domácej a zahraničnej scéne. Je založená na inovatívnosti vedeckého smerovania, ambicióznosti vedeckých osobností, ako aj na autonómnosti vedúcich vedeckých tímov. Správnosť tohto smerovania dokumentuje pozícia ústavu, ktorý je hodnotený na popredných priečkach vo všetkých procesoch hodnotenia v SAV.

Základnými a dominantnými cieľmi, ktorým sú podriadené všetky aspekty chodu ústavu, sú odborný rast, medzinárodná integrácia a spoločenské uplatnenie/úžitok výsledkov výskumu. Napĺňanie uvedených cieľov si vyžaduje komplexný prienik aspektov, ako sú:

- aktívna účasť na domácich a zahraničných projektoch,
- aktívna publikačná činnosť v medzinárodných časopisoch a prezentácia výsledkov výskumu na medzinárodných vedeckých fórach,
- zachovanie vekovej a odbornej kontinuity,
- vytvorenie podmienok pre vzdelávanie a odborný rast nielen PhD študentov a mladých vedeckých pracovníkov, ale aj erudovaných vedeckých pracovníkov,
- aktívna účasť na vzdelávacom procese s dôrazom na druhý a tretí stupeň vysokoškolského vzdelania,
- technické zabezpečenie pre výskum,
- finančné zabezpečenie výskumu,
- personálna politika,
- zabezpečenie kontinuity v oblasti vedenia organizačných štruktúr ústavu, vytvorenie podmienok pre manažérsky rast pracovníkov,
- diseminácia a popularizácia objektov a výsledkov výskumu v odbornej a laickej spoločnosti,
- spolupráca a kooperácia s domácimi a zahraničnými akademickými, ako aj priemyselnými partnermi,
- zabezpečenie fungovania administratívnych požiadaviek.

### Projektové tímy

Štruktúra ústavu v sebe inherentne zahŕňa flexibilné projektové tímy, ktoré sú vytvárané s ohľadom na objektové, resp. metodické možnosti a schopnosti jednotlivcov spájajúcich sa účelovo pri príprave a riešení projektov MŠ SR (štátne programy, projekty ŠF), VEGA, APVV, rámcových programov EÚ, NATO a v spolupráci s domácimi a zahraničnými partnermi z priemyslu. Táto flexibilná projektová štruktúra umožňuje pracovníkom resp. odborným skupinám podieľať sa na príprave vnútro-ústavných alebo aj mimo-ústavných vedeckých zoskupení, buď v rámci ústavu a SAV alebo aj mimo nich. Vedúci projektových tímov sú autonómni v rozhodovaní o spôsoboch riešenia projektu ako aj v nakladaní s finančnými prostriedkami v súlade s projektovými cieľmi a zmluvami.

### Personálna politika

V oblasti personálnej politiky sa ústavu dlhodobo darí udržať relatívne nízky priemerný vek zamestnancov pod 47 rokov. Podpora zamestnávania mladých vedeckých pracovníkov patrí medzi prioritné úlohy vedenia ústavu. Pre zvýšenie počtu a motivácie mladých absolventov doktorandského štúdia, aby neodchádzali z oblasti vedy do finančne lukratívnejších zamestnaní, boli prijaté nasledujúce zásady personálnej politiky:

- Získavanie najlepších študentov na doktorandské štúdium vo vedných odboroch, ktoré má ústav akreditované ako externá vzdelávacia inštitúcia.
- Získavanie zahraničných doktorandov prostredníctvom projektov Marie Curie Research Training Network alebo iných schém podpory zahraničných študentov (napr. DAAD), v ktorých je ústav zapojený.
- Vysielanie čerstvých absolventov doktorandského štúdia na dlhodobé (najmenej 3 mesiace) pobyty do zahraničia, aby sa zoznámili s najmodernejšou prístrojovou technikou, laboratórnymi postupmi a metódami práce vo vyspelých pracoviskách v Európe a vo svete (najčastejšie Japonsko a USA).
- Organizovanie medzinárodných podujatí doma, ako aj vysielanie mladých vedeckých pracovníkov a doktorandov na renomované konferencie v zahraničí s cieľom získať skúsenosti s prezentovaním vedeckých výsledkov.

- Pozývanie renomovaných odborníkov zo zahraničia na prednášky pre doktorandov a zamestnancov ústavu.

S cieľom plnenia stanovených zásad personálnej politiky sa Ústav anorganickej chémie ako hostiteľská organizácia zaradil k úspešným prijímateľom projektov mobilného programu Slovenskej akadémie vied – SASPRO – traja štipendisti v 2018.

### **Technická infraštruktúra**

Neoddeliteľnou súčasťou vednej politiky je aj rozvoj infraštruktúry. Ústav cielene buduje svoju infraštruktúru na rôznych úrovniach cez laboratóriá na prípravu vzoriek až po laboratória na charakterizáciu pripravených materiálov. Vyžaduje si to dlhodobú aktivitu postupnej rekonštrukcie priestorov, ktorá je pre svoje špecifické požiadavky náročná ako finančne, tak aj časovo, pretože prebieha pri plnej prevádzke ostatných zariadení. Prístrojové vybavenie sleduje vzájomnú komplementaritu techník. Snahou je aj poskytovať voľné časové kapacity na merania pre partnerov na Slovensku, ako aj zapájanie ústavu prostredníctvom technickej infraštruktúry do medzinárodných zväzkov.

## 6. Spolupráca s univerzitami/vysokými školami, štátnymi a neziskovými inštitúciami okrem aktivít uvedených v kap. 2, 3, 4

### 6.1. Spolupráca s univerzitami/VŠ (fakultami)

**Názov univerzity/vysokej školy a fakulty:** Prírodovedecká fakulta UK

**Druh spolupráce (spoločné pracovisko alebo iné):** Spoločná výchova doktorandov, spoločné riešenie projektov, spolupráca v pedagogickom procese

**Začiatok spolupráce:** 1990

**Zameranie:** vedecká spolupráca, účasť na Bc. a Mgr. výuke

**Zhodnotenie:** V spolupráci s touto fakultou je ústav zapojený do vzdelávania na III. stupni vysokoškolského štúdia v študijných programoch „Anorganická chémia” a „Chemická fyzika”. Spoločne sa riešia projekty VEGA a APVV. Prof. RNDr. J. Noga, DrSc. a prof. RNDr. J. Bujdák, DrSc. majú hlavný úväzok na fakulte a čiastkový na ÚACh SAV. Prof. RNDr. J. Noga, DrSc. bol do 25.4. 2018 externým členom Vedeckej rady ÚACh SAV, prof. RNDr. J. Bujdák, DrSc. je interným členom VR ústavu. Pracovníci ÚACh viedli na PríF UK v roku 2018 dvoch doktorandov.

**Názov univerzity/vysokej školy a fakulty:** Fakulta chemickej a potravinárskej technológie STU

**Druh spolupráce (spoločné pracovisko alebo iné):** Spoločné pracovisko, spoločná výchova doktorandov

**Začiatok spolupráce:** 1990

**Zameranie:** vedecká spolupráca

**Zhodnotenie:** Na základe dodatku k zmluve o zriadení spoločného pracoviska je FChPT od roku 2008 členom konzorcia a spoluzriaďovateľom spoločného pracoviska, Centra kompetencie skla Vitrum Laugaricio – VILA. Pracovníci ÚACh viedli na FChPT v roku 2018 piatich doktorandov.

**Názov univerzity/vysokej školy a fakulty:** Fakulta materiálov, metalurgie a recyklácie TUKE

**Druh spolupráce (spoločné pracovisko alebo iné):** Spolupráca v pedagogickom procese

**Začiatok spolupráce:** 2000

**Zameranie:** vedecká spolupráca, účasť na Bc. a Mgr. výuke

**Zhodnotenie:** V spolupráci s touto fakultou je ústav zapojený do pedagogického procesu. Prof. RNDr. P. Šajgalík, DrSc. je členom vedeckej rady fakulty.

**Názov univerzity/vysokej školy a fakulty:** Trenčianska univerzita Alexandra Dubčeka v Trenčíne

**Druh spolupráce (spoločné pracovisko alebo iné):** Centrum kompetencie skla - Vitrum Laugaritio

**Začiatok spolupráce:** 1997

**Zameranie:** vedecká spolupráca

**Zhodnotenie:** Okrem spoločného pracoviska s TnU AD (Centrum kompetencie skla Vitrum Laugaritio) riešil ÚACh SAV v roku 2018 v spolupráci s touto univerzitou 3 spoločné VEGA a dva spoločné APVV projekty. Prof. Ing. P. Galusek, DrSc. prorektor pre vedu, výskum a medzinárodné vzťahy TnU AD je aj členom Vedeckej rady TnU AD a dvoch jej fakúlt (Fakulty zdravotníctva a Fakulty špeciálnej techniky), prof. Ing. M. Liška, DrSc. bol do 25. 4. 2018 externým členom Vedeckej rady ÚACh. Pracovníci centra, zamestnanci ÚACh, sa podieľajú na pedagogickej činnosti v rámci vysokoškolského štúdia v odbore "Chemické technológie" a doktorandského štúdia v odbore "Anorganická technológia".

**Názov univerzity/vysokej školy a fakulty:** Vysoká škola báňská - TU Ostrava, Česká republika

**Druh spolupráce (spoločné pracovisko alebo iné):** Spoločná výchova doktorandov, spoločné riešenie projektov

**Začiatok spolupráce:** 2010

**Zameranie:** vedecká spolupráca, výchova doktorandov

**Zhodnotenie:** Spolupráca VŠB a ÚACh je zameraná na výchovu mladých pracovníkov. Na ÚACh pokračovala vo svojom štúdiu jedna doktorandka z VŠB Ostrava. Prof. RNDr. P. Šajgalík, DrSc. je členom Vedeckej rady FMMI VŠB; doc. Ing. Z. Lenčoš, PhD. je členom odborovej rady doktorandského študijného programu Materiálové vedy a inžinýrství.

**Názov univerzity/vysokej školy a fakulty:** Montanuniversitaet Leoben, Rakúsko

**Druh spolupráce (spoločné pracovisko alebo iné):** Spoločná výchova doktorandov, spoločné riešenie projektov

**Začiatok spolupráce:** 2008

**Zameranie:** vedecká spolupráca, výchova doktorandov

**Zhodnotenie:** Spolupráca je zameraná na výchovu mladých doktorandov so zameraním na pokročilé žiaruvzdorné keramické materiály. Prof. RNDr. P. Šajgalík, DrSc. a doc. Ing. Z. Lenčéš, PhD. sú školiteľmi špecialistami doktorandov.

**Názov univerzity/vysokej školy a fakulty:** University of Ghent, Belgicko

**Druh spolupráce (spoločné pracovisko alebo iné):** Department of Inorganic and Physical Chemistry

**Začiatok spolupráce:** 2010

**Zameranie:** vedecká spolupráca

**Zhodnotenie:** Vedecká spolupráca pri príprave amorfných a polykryštalických materiálov sol-gel metódami v systémoch  $\text{Al}_2\text{O}_3\text{-La}_2\text{O}_3$ ,  $\text{Al}_2\text{O}_3\text{-La}_2\text{O}_3\text{-ZrO}_2$ ,  $\text{Al}_2\text{O}_3\text{-Y}_2\text{O}_3$ . Skúmanie vlastností pripravených materiálov a spoločné publikácie.

**6.2. Významné aplikácie výsledkov výskumu v spoločenskej praxi alebo vyriešenie problému pre štátnu alebo neziskovú inštitúciu**

**6.3. Iná činnosť využiteľná pre potreby spoločenskej praxe**

## 7. Spolupráca s aplikačnou a hospodárskou sférou okrem aktivít uvedených v kap. 2, 3, 4

### 7.1. Spoločné pracoviská s aplikačnou sférou

**Názov pracoviska:** Spoločné pracovisko Ústavu anorganickej chémie Slovenskej akadémie vied a RONA, a.s.

**Partner(i):** Rona a.s., Lednické Rovne

**Zameranie:** Stimulácia, rozvoj a realizácia základného a aplikovaného výskumu a vývoja v oblastiach súvisiacich s existujúcou priemyselnou základňou SR

**Rok založenia:** 2011

**Zhodnotenie:** V roku 2018 bol podaný projekt v rámci všeobecnej výzvy APVV, v ktorej je žiadateľom projektu Trenčianska univerzita AD a RONA a.s. vystupuje aj s ústavom ako partnerská organizácie.

### 7.2. Kontraktový – zmluvný výskum (vrátane zahraničných kontraktov)

**Názov kontraktu:** Výskum a vývoj pokročilých žiaruvzdorných materiálov na báze Al-Si-O-C-N a Zr-O-C-N

**Partner(i):** RHI AG Leoben, Rakúsko

**Začiatok spolupráce** (v súlade s podpísaným kontraktom): 2017

**Ukončenie spolupráce** (ak ide o spoluprácu v krátkom období): trvá

**Objem získaných prostriedkov v bežnom roku (€):** 4700

**Stručný opis výstupu/výsledku:** Jedná sa o firemný výskum, P. Šajgalík a Z. Lenčoš sú viazaní mlčanlivosťou, nakoľko výsledky výskumu môžu byť predmetom patentu.

**Názov kontraktu:** Vývoj transparentnej keramiky a iných materiálov

**Partner(i):** CEIT a.s.

**Začiatok spolupráce** (v súlade s podpísaným kontraktom): 2017

**Ukončenie spolupráce** (ak ide o spoluprácu v krátkom období): trvá

**Objem získaných prostriedkov v bežnom roku (€):** 0

**Stručný opis výstupu/výsledku:** V rámci zmluvného výskumu boli realizované čiastkové úlohy spojené s optimalizáciou procesu úpravy vstupných surovín pre prípravu monokryštálov zařiru a YAG metódou horizontálne smerovanej kryštalizácie. Optimalizáciou úpravy bolo možné zvýšenie efektivity následného procesu kryštalizácie z pohľadu množstva pripraveného monokryštálu.

**Zhodnotenie:** Výskumný zámer bude pokračovať v zmysle prípravy monokryštálov s riadenou orientáciou a sledovania vlastností takto pripravených monokryštálov.

**Názov kontraktu:** Mapping of the key alumina characteristics for optimal dissolution performance

**Partner(i):** ALUMINIUM PECHINEY, Francúzsko a Hydro Aluminium AS, Nórsko

**Začiatok spolupráce** (v súlade s podpísaným kontraktom): 2018

**Ukončenie spolupráce** (ak ide o spoluprácu v krátkom období): trvá

**Objem získaných prostriedkov v bežnom roku (€):** 120000

**Stručný opis výstupu/výsledku:**

### 7.3. Iná činnosť využiteľná pre potreby hospodárskej praxe



## 8. Aktivity pre Národnú radu SR, vládu SR, ústredné orgány štátnej správy SR a iné organizácie

### 8.1. Členstvo v poradných zboroch vlády SR, Národnej rady SR, ministerstiev SR, orgánoch EÚ, EP, NATO a pod.

Tabuľka 8a Členstvo v poradných zboroch Národnej rady SR, vlády SR, ministerstiev SR, orgánoch EÚ, EP, NATO a pod.

Meno pracovníka	Názov orgánu	Funkcia
Mgr. Stanislav Kedžuch, PhD.	Slovenská komisia chemickej olympiády	podpredseda
Ing. Michal Korenko, PhD.	Komisia pre námietky pri verejnom obstarávaní	externý člen
RNDr. Jana Madejová, DrSc.	Agentúra na podporu výskumu a vývoja	Člen rady pre prírodné vedy
prof. RNDr. Jozef Noga, DrSc.	Akreditačná komisia SR	člen pracovnej skupiny pre oblasť výskumu Chémia, chemická technológia a biotechnológie
prof. RNDr. Pavol Šajgalík, DrSc.	Komisia ministra školstva pre udeľovanie Ceny ministra školstva	člen
	Rada predsedov pracovných skupín pre prioritné oblasti aplikovaného výskumu a experimentálneho vývoja	predseda
	Pandemická komisia MZ SR	člen
	Rada vlády pre vedu, techniku a inovácie	podpredseda
	Slovenská komisia pre vedecké hodnoty (SKVH)	podpredseda
	Výskumná agentúra SR	člen
	Komisia MŠ pre prioritné oblasti aplikovaného výskumu a experimentálneho vývoja v SR - materiálový výskum a nanotechnológie	člen pracovnej skupiny
	Technologická agentúra SR	člen

### 8.2. Expertízna činnosť a iné služby pre štátnu správu a samosprávy

### 8.3. Členstvo v radách štátnych programov a podprogramov ŠPVV a ŠO

Tabuľka 8b Členstvo v radách štátnych programov a podprogramov ŠPVV a ŠO

Meno pracovníka	Názov orgánu	Funkcia
-----------------	--------------	---------

### 8.4. Prehľad aktuálnych spoločenských problémov, ktoré riešilo pracovisko v spolupráci s Kanceláriou prezidenta SR, s vládnymi a parlamentnými orgánmi alebo pre ich potrebu

## 9. Vedecko-organizačné a popularizačné aktivity

### 9.1. Vedecko-popularizačná činnosť

Tabuľka 9a Súhrnné počty vedecko-popularizačných činností organizácie SAV

Typ	Počet	Typ	Počet	Typ	Počet
prednášky/besedy	4	tlač	0	TV	4
rozhlas	0	internet	6	exkurzie	3
publikácie	1	multimediálne nosiče	0	dokumentárne filmy	0
iné	3				

### 9.2. Vedecko-organizačná činnosť

Tabuľka 9b Vedecko-organizačná činnosť

Názov podujatia	Domáca/ medzinárodná	Miesto	Dátum konania	Počet účastníkov
Smolenice GOLDCAT workshop	domáca	Smolenice, Slovensko	22.11.-24.11.2018	10
11th Workshop on Modern Methods in Quantum Chemistry	medzinárodná	Mariapfarr, Rakúsko	25.02.-02.03.2018	47
5th Workshop of Slovak Clay Group Clay minerals and selected non-raw materials in material science, industrial applications and environmental technology	medzinárodná	Banská Štiavnica, Slovensko	21.05.-23.05.2018	27
9. odborný seminár "Interakcie tavenín s progresívnymi anorganickými materiálmi"	medzinárodná	Borinka, Slovensko	15.10.-16.10.2018	24

### 9.3. Účasť na výstavách

**Názov výstavy:** Vedecký veľtrh

**Miesto konania:** NC Eurovea v Bratislave

**Dátum:** 14.9.2018

**Zhodnotenie účasti:** V stánku ÚACh SAV–, s názvom "Anorganické materiály pre budúcnosť", mohli návštevníci vidieť chemické experimenty s práškovým hliníkom, koróziu materiálov, teoretické výpočty ílových minerálov pri reakcii s organickými kationmi, ďalej keramické a biokeramické materiály alebo tiež agregáciu organických farbív. Organizátori veľtrhu si stanovili za cieľ hravou formou priblížiť vedu žiakom základných a stredných škôl, ale i zvedavým dospelým. Účastníci vedeckého veľtrhu za ÚACH: – M. Hičák, S. Belušáková, V. Pavlík, P. Škorňa, M. Slaný

**Názov výstavy:** Víkend so SAV

**Miesto konania:** Primaciálne námestie v Bratislave

**Dátum:** 7.9.2018

**Zhodnotenie účasti:** Ambíciou podujatia bola prezentácia výsledkov vedy a výskumu vedcov SAV širokej verejnosti všetkých vekových kategórií. Špičkoví odborníci z oblasti biomedicíny, polymérov, chémie, fyziky, archeológie, vied o Zemi, elektrotechniky, biodiverzity rastlín, histórie, filozofie, slavistiky, mechaniky strojov, či astronómie boli k dispozícii pre tzv. živú knihu - otvorenú diskusiu o tajomstvách a atraktivnosti rôznych vedeckých odvetví (napr. experimenty v CERNE, o energetickej udržateľnosti na našej

planéte, o evolúcii, slnku a astronómii, ale aj o vývoji nanomateriálov a podobne). Účastníci víkendu z ÚACh: M. Boča, O. Hanzel, M. Kontrík, V. Kureková, V. Pavlík, M. Barlog.

**Názov výstavy:** Európska noc výskumníkov

**Miesto konania:** Stará tržnica, Bratislava

**Dátum:** 28.9.2018

**Zhodnotenie účasti:** Festival vedy Európska noc výskumníkov je projekt podporovaný rámcovým programom Európskej komisie na podporu výskumu, vývoja a inovácií - Horizon 2020 ako aj Ministerstvom školstva, vedy, výskumu a športu. Európska noc výskumníkov je paralelne organizovaná v 24 štátoch Európy. Cieľovou skupinou projektu sú predovšetkým deti v školskom veku, pričom dôraz je kladený na zvýšenie ich záujmu o štúdium prírodných vied a technických smerov na vysokých školách. Zameranie výskumu ústavu a výsledky za jednotlivé oddelenia prezentovali – M. Hičák, Z. Fördösová, M. Slaný, V. Kureková, S. Belušáková, O. Hanzel, Ů. Hakan, D.M. Rodríguez

#### 9.4. Účasť v programových a organizačných výboroch národných konferencií

Tabuľka 9c Programové a organizačné výbory národných konferencií

Meno pracovníka Spolu	Programový	Organizačný	Programový i organizačný
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#### 9.5. Členstvo v redakčných radách časopisov

doc. Ing. Miroslav Boča, DrSc.

Chemical Papers (funkcia: Editorial Advisory Board od 9/2013 )

prof. RNDr. Juraj Bujdák, DrSc.

Applied Clay Science (funkcia: associate editor)

Chemistry Africa (Springer) (funkcia: associate editor)

ChemistrySelect (Wiley-VCH) (funkcia: člen redakčnej rady )

prof. Ing. Dušan Galusek, DrSc.

Ceramics-Silikáty (funkcia: člen)

New Journal of Glass and Ceramics (funkcia: člen)

RNDr. Peter Komadel, DrSc.

Applied Clay Science (funkcia: člen)

Clay Minerals (funkcia: člen)

Geologica Carpathica (funkcia: člen)

doc. Ing. Zoltán Lenčéš, PhD.

Journal of the Ceramic Society of Japan (funkcia: člen)

prof. Ing. Marek Liška, DrSc.

Ceramics - Silikáty (funkcia: člen)

European Journal of Glass Science and Technology (funkcia: regional editor)

International Journal of Applied Glass Science (funkcia: člen)

Sklář a keramik (funkcia: člen)

RNDr. Jana Madejová, DrSc.

Clays and Clay Minerals (funkcia: associate editor)

prof. RNDr. Pavol Šajgalík, DrSc.

Ceramics-Silikáty (funkcia: člen)

Journal of Asian Ceramic Society (funkcia: spolueditor)

Journal of Ceramic Science and Technology (funkcia: člen)

Keramický Zpravodaj (funkcia: člen)  
Processing and Application of Ceramics (funkcia: člen)

## 9.6. Činnosť v domácich vedeckých spoločnostiach

Mgr. Silvia Belušáková, PhD.

Slovenská ílová spoločnosť (funkcia: člen)  
Slovenská spektroskopická spoločnosť (funkcia: člen)

doc. Ing. Miroslav Boča, DrSc.

Humboldtov klub v SR (funkcia: člen)  
Slovenská chemická spoločnosť (funkcia: člen)

Mgr. Peter Boháč, PhD.

Slovenská ílová spoločnosť (funkcia: člen)

prof. RNDr. Juraj Bujdák, DrSc.

Slovenská chemická spoločnosť (funkcia: člen)  
Slovenská ílová spoločnosť (funkcia: člen výboru)

Mgr. Roman Bystrický, PhD.

Slovenská silikátová vedecko-technická spoločnosť (funkcia: člen)

Mgr. Adriana Czímerová, PhD.

Slovenská ílová spoločnosť (funkcia: člen)

Mgr. Alexander Čeklovský, PhD.

Slovenská spektroskopická spoločnosť (funkcia: člen)

prof. Ing. Dušan Galusek, DrSc.

Humboldtov klub v SR (funkcia: člen)  
Slovenská silikátová vedecko-technická spoločnosť (funkcia: podpredseda)  
Slovenská sklárska spoločnosť (funkcia: člen predstavenstva, vedecký tajomník)

Ing. Ondrej Hanzel, PhD.

Slovenská silikátová vedecko-technická spoločnosť (funkcia: člen)

doc. Ing. Miroslav Hnatko, PhD.

Slovenská chemická spoločnosť (funkcia: člen)  
Slovenská silikátová vedecko-technická spoločnosť (funkcia: člen)

Ing. Mária Chromčíková, PhD.

Česká sklárska spoločnosť (funkcia: člen)  
Slovenská sklárska spoločnosť (funkcia: člen)

Mgr. Ľuboš Jankovič, PhD.

Slovenská ílová spoločnosť (funkcia: člen)

Mgr. Stanislav Kedžuch, PhD.

Slovenská chemická spoločnosť (funkcia: člen predsedníctva)

RNDr. Peter Komadel, DrSc.

Slovenská chemická spoločnosť (funkcia: člen)  
Slovenská ílová spoločnosť (funkcia: člen)  
Učená spoločnosť SAV (funkcia: člen)

Ing. Michal Korenko, PhD.

Slovenská chemická spoločnosť (funkcia: predseda revíznej komisie)  
Slovenská nukleárna spoločnosť (funkcia: člen)  
Slovenská silikátová vedecko-technická spoločnosť (funkcia: člen)  
Slovenská spoločnosť pre povrchové úpravy (funkcia: člen)

Ing. Blanka Kubíková, PhD.

Slovenská chemická spoločnosť (funkcia: člen)

Mgr. Valéria Kureková, PhD.

Slovenská chemická spoločnosť (funkcia: člen)  
Slovenská ílová spoločnosť (funkcia: člen)

doc. Ing. Zoltán Lenčák, PhD.

Humboldtov klub v SR (funkcia: člen)  
Slovenská silikátová vedecko-technická spoločnosť (funkcia: člen výboru)

prof. Ing. Marek Liška, DrSc.

Slovenská chemická spoločnosť (funkcia: člen)  
Slovenská sklárska spoločnosť (funkcia: člen)

RNDr. Jana Madejová, DrSc.

Slovenská chemická spoločnosť (funkcia: člen)  
Slovenská ílová spoločnosť (funkcia: podpredseda)  
Učená spoločnosť SAV (funkcia: člen)

Ing. Jarmila Mlynáriková, PhD.

Slovenská chemická spoločnosť (funkcia: člen)

Daniel Moreno

Slovenská ílová spoločnosť (funkcia: člen)

Ing. Zuzana Netriová, PhD.

Slovenská chemická spoločnosť (funkcia: člen)

prof. RNDr. Jozef Noga, DrSc.

Humboldtov klub v SR (funkcia: člen)  
Slovenská akademická spoločnosť (funkcia: podpredseda)  
Učená spoločnosť SAV (funkcia: predseda)

Ing. Helena Pálková, PhD.

Slovenská ílová spoločnosť (funkcia: člen výboru)

Ing. Viliam Pavlík, PhD.

Slovenská chemická spoločnosť (funkcia: člen)

Ing. Anna Prnová, PhD.

Slovenská silikátová vedecko-technická spoločnosť (funkcia: člen)  
Slovenská Sklárska spoločnosť (funkcia: člen)

Ing. Jaroslav Sedláček, PhD.

Slovenská silikátová vedecko-technická spoločnosť (funkcia: člen)

Ing. Eva Scholtzová, CSc.

Slovenská chemická spoločnosť (funkcia: člen)  
Slovenská ílová spoločnosť (funkcia: člen)

Ing. Michal Slaný

Slovenská ílová spoločnosť (funkcia: člen)

prof. RNDr. Pavol Šajgalík, DrSc.

Humboldtov klub v SR (funkcia: člen)

Slovenská chemická spoločnosť (funkcia: člen)

Slovenská silikátová vedecko-technická spoločnosť (funkcia: predseda)

Slovenská sklárska spoločnosť (funkcia: člen predstavenstva)

Učená spoločnosť SAV (funkcia: člen)

Ing. František Šimko, PhD.

Slovenská chemická spoločnosť (funkcia: člen)

doc. Ing. Peter Šimurka, PhD.

Zväz slovenských vedecko-technických spoločností (funkcia: člen rady)

Ing. Peter Škorňa, PhD.

Slovenská ílová spoločnosť (funkcia: člen)

Mgr. Peter Švančárek, PhD.

Slovenská sklárska spoločnosť (funkcia: člen)

Ing. Zuzana Vasková, PhD.

Slovenská chemická spoločnosť (funkcia: člen)

## 9.7. Iné dôležité informácie o vedecko-organizačných a popularizačných aktivitách

### **Deň otvorených dverí na ÚCh SAV**

Miesto konania: ÚCh SAV, Bratislava

Dátum: 07.11.2018

Zhodnotenie účasti: Dňa 07.11.2018 organizoval Ústav anorganickej chémie SAV v rámci Týždňa vedy a techniky na Slovensku „Deň otvorených dverí ÚCh SAV“. Pozvaní boli študenti hlavne stredných, ale aj vysokých škôl zo Slovenska. Na úvod bola pre mladých návštevníkov pripravená prednáška „Svet moderných keramických materiálov“. Nasledovala prehliadka vybraných laboratórií ústavu, v ktorých mladí vedecí pracovníci prostredníctvom modelových experimentov návštevníkom priblížili svoju každodennú prácu a informovali o praktickom využití zariadení. Tým najviac zvedavým názorne ukázali ich využitie aj nad rámec demonštračných experimentov. Návštevníkov najviac zaujala prezentácia skenovacieho elektrónového mikroskopu, chemické experimenty s fluorescenčnými farbivami a rôzne experimenty s tekutým dusíkom. Dňa otvorených dverí sa zúčastnilo približne 40 študentov z bratislavských aj mimobratislavských stredných škôl (Bratislava, Senica).

## 10. Činnosť knižnično-informačného pracoviska

### 10.1. Knižničný fond

Tabuľka 10a Knižničný fond

<b>Knižničné jednotky spolu</b>		7594
z toho	knihy a zviazané periodiká	7594
	audiovizuálne dokumenty	
	elektronické dokumenty (vrátane digitálnych)	
	mikroformy	
	iné špeciálne dokumenty - dizertácie, výskumné správy	
	Rukopisy, vzácne tlače	
Počet titulov dochádzajúcich periodík		
z toho zahraničné periodiká		
Ročný prírastok knižničných jednotiek		12
v tom	kúpou	12
	darom	
	výmenou	
	bezodplatným prevodom	
	náhradou	
Úbytky knižničných jednotiek		
Knižničné jednotky spracované automatizovane		

Výraz „**v tom**“ označuje úplné (vyčerpujúce) údaje, ktorých súčet sa musí rovnať údaju v riadku „spolu“, čiže nadradenému riadku.

Výraz „**z toho**“ označuje neúplné (výberové) údaje, ktorých súčet sa nemusí rovnať údaju v riadku „spolu“.

### 10.2. Výpožičky a služby

Tabuľka 10b Výpožičky a služby

<b>Výpožičky spolu (riadok 1)</b>		32
v tom z	prezenčné výpožičky	28
r. 1	absenčné výpožičky	4
v tom z	odborná literatúra pre dospelých	24
r. 1	výpožičky periodík	8
MVS iným knižniciam		
MVS z iných knižníc		
MMVS iným knižniciam		
MMVS z iných knižníc		
Počet vypracovaných bibliografií		
Počet vypracovaných rešerší		

**10.3. Používatelia**

Tabuľka 10c Používatelia

Registrovaní používatelia	60
Návštevníci knižnice spolu (bez návštevníkov podujatí)	61

**10.4. Iné údaje**

Tabuľka 10d Iné údaje

On-line katalóg knižnice na internete ( 1=áno, 0=nie)	
Náklady na nákup knižničného fondu v €	1414,97

**10.5. Iné informácie o knižničnej činnosti**



## 11. Aktivity v orgánoch SAV

### 11.1. Členstvo vo Výbore Snemu SAV

### 11.2. Členstvo v Predsedníctve SAV a vo Vedeckej rade SAV

prof. RNDr. Pavol Šajgalík, DrSc.

- Predseda SAV
- predseda VR SAV

### 11.3. Členstvo vo vedeckých kolégiách SAV

doc. Ing. Miroslav Boča, DrSc.

- VK SAV pre chemické vedy (člen)

RNDr. Peter Komadel, DrSc.

- VK SAV pre chemické vedy (člen)

RNDr. Jana Madejová, DrSc.

- VK SAV pre chemické vedy (člen)

prof. RNDr. Jozef Noga, DrSc.

- VK SAV pre chemické vedy (člen)

prof. RNDr. Pavol Šajgalík, DrSc.

- VK SAV pre chemické vedy (člen)

### 11.4. Členstvo v komisiách SAV

doc. Ing. Miroslav Boča, DrSc.

- Komisia SAV pre vyhodnocovanie medzinárodných projektov (člen)

RNDr. Peter Komadel, DrSc.

- Komisia SAV pre zahraničné styky (člen)

### 11.5. Členstvo v orgánoch VEGA

doc. Ing. Miroslav Boča, DrSc.

- Komisia VEGA č. 3 pre chemické vedy, chemické inžinierstvo a biotechnológie (predseda)

prof. Ing. Dušan Galusek, DrSc.

- Komisia VEGA č. 7 pre strojárstvo a príbuzné odbory informačných a komunikačných technológií a materiálové inžinierstvo (člen)

RNDr. Peter Komadel, DrSc.

- Komisia VEGA č. 3 pre chemické vedy, chemické inžinierstvo a biotechnológie (člen)

doc. Ing. Zoltán Lenčéš, PhD.

- Komisia VEGA č. 7 pre strojárstvo a príbuzné odbory informačných a komunikačných technológií a materiálové inžinierstvo (člen)

Dr. Oľga Malkin, DrSc.

- Komisia VEGA č. 3 pre chemické vedy, chemické inžinierstvo a biotechnológie (člen)

## 12. Hospodárenie organizácie

### 12.1. Výdavky RO SAV

Tabuľka 12a Výdavky RO SAV (v €)

V ý d a v k y	Skutočnosť k 31.12.2018 spolu	v tom:			
		zo ŠR	z toho: ŠF EÚ vr. spolufinan .zo ŠR	z mimorozp. zdrojov	z toho: ŠF EÚ vr. spolufinan.zo ŠR
<b>Výdavky spolu</b>	2 116 523	1 401 341		715 182	23 470
<b>Bežné výdavky</b>	2 116 523	1 401 341		715 182	23 470
<b>v tom:</b>					
mzdy (610)	1 010 545	825 662		184 883	
poistné a príspevok do poisťovní (620)	369 252	287 377		81 875	
tovary a služby (630)	549 529	232 619		316 910	23 470
z toho: časopisy	3 012	1 298		1 714	
VEGA projekty	111 592	111 592			
MVTS projekty	53 105	53 105			
CE					
vedecká výchova	2 560	2 560			
bežné transfery (640)	55 683	55 683			
z toho: štipendiá	41 650	41 650			
transfery partnerom projektov	131 514			131 514	
<b>Kapitálové výdavky</b>					
<b>v tom:</b>					
obstarávanie kapitálových aktív					
kapitálové transfery					
z toho: transfery partnerom projektov					

### 12.2. Príjmy RO SAV

Tabuľka 12b Príjmy RO SAV (v €)

P r í j m y	Skutočnosť k 31.12.2018 spolu	v tom:	
		rozpočtové	z mimorozp. zdrojov
<b>Príjmy spolu</b>	788 421	23 030	765 391

<b>Nedaňové príjmy</b>	788 421	23 030	765 391
<b>v tom:</b>			
príjmy z prenájmu			
príjmy z predaja výrobkov a služieb	21 860	21 860	
iné	766 561	1 170	765 391
<b>Granty a transfery (mimo zdroja 111)</b>	765 391		765 391
<b>v tom:</b>			
tuzemské	485 229		485 229
<b>z toho: APVV</b>	477 729		477 729
iné	7 500		7 500
zahraničné	280 162		280 162
z toho: projekty rámcového programu EÚ	99 698		99 698
iné	180 464		180 464

### 13. Nadácie a fondy pri organizácii SAV

### 14. Iné významné činnosti organizácie SAV

## 15. Vyznamenania, ocenenia a ceny udelené pracovníkom organizácie v roku 2018

### 15.1. Domáce ocenenia

#### 15.1.1. Ocenenia SAV

##### **Belušáková Silvia**

Fond Štefana Schwarza

Oceňovateľ: Predsedníctvo SAV

Opis: Podporný fond Štefana Schwarza na vytváranie postdoktorandských miest v SAV pre vynikajúcich absolventov doktorandského štúdia.

#### 15.1.2. Iné domáce ocenenia

##### **Belušáková Silvia**

Súťaž vedeckých prác mladých spektroskopikov

Oceňovateľ: Slovenská spektroskopická spoločnosť

Opis: Ocenenie za práce venované opisu Försterovho rezonančného prenosu energie v sústavách hybridných nanomateriálov na báze vrstevnatých kremičitanov a organických laserových farbív (1 miesto).

##### **Boháč Peter**

Súťaž vedeckých prác mladých spektroskopikov

Oceňovateľ: Slovenská spektroskopická spoločnosť

Opis: Za vedeckú prácu venovanú využitiu spektrometrických metód pri hodnotení fotofyzikálnych

vlastností kyanínových farbív s vrstevnatými kremičitanmi (3. miesto)

**Madejová Jana**

Nominantka ankety Slovenka roka 2018 v kategórii Veda a výskum

Oceňovateľ: Týždenník Slovenka v spolupráci s RTVS a Slovenským národným divadlom

Opis: Filozofiou ankety SLOVENKA ROKA je prezentovať dámy, ktoré sú výnimočné a úspešné vo svojom povolání, svojím umom, nadaním a pracovitosťou dokázali niečo výnimočné a ktoré mnohokrát svojou prácou zviditeľnili Slovensko v zahraničí.

**15.2. Medzinárodné ocenenia****Komorovský Stanislav**

Cena Petra Sedmery

Oceňovateľ: Spektroskopická spoločnosť Jana Marka Marci, Česká Republika

Opis: Cena je udeľovaná za najlepšiu publikovanú prácu v odbore nukleárnej magnetickej rezonancie. Cena za rok 2018 bola udelená za článok J. Am. Chem. Soc. 138, 8432-8445 (2016).

**Lenčič Zoltán**

Cena za medzinárodnú spoluprácu (Prize for International Cooperation)

Oceňovateľ: Poľská keramická spoločnosť

Opis: Cena bola udelená 10.9.2018, Krakow.

**16. Poskytovanie informácií v súlade so zákonom č. 211/2000 Z. z. o slobodnom prístupe k informáciám v znení neskorších predpisov (Zákon o slobode informácií)**

## 17. Problémy a podnety pre činnosť SAV

Zásadný problém, ktorý narastá niekoľko rokov a v roku 2018 sa prejavil bez náznakov zlepšenia, je absurdný nárast administratívnych nárokov na všetkých úrovniach. Dominuje im oblasť verejného obstarávania. Pre potreby naplnenia legislatívnych povinností ústavu v oblasti verejného obstarávania je jeden plný úväzok pre administratívneho pracovníka málo, ale mzdové prostriedky ústavu neumožňujú rozšírenie administratívy. Výsledkom je, že potrebnú aktivitu vykonáva približne 5 vedeckých pracovníkov, nad rámec alebo na úkor svojich odborných aktivít. Táto situácia je absolútne neúnosná. Deklarovaná snaha P SAV pomôcť organizáciám v tejto situácii je vítaná, ale stále nie je naplnená.

Jednou z možností, ako by mohlo Predsedníctvo pomôcť organizáciám s prebujnelou administratívou, je zabezpečiť poistenie majetku (hlavne z dôvodu požiadavky VA) pre všetky organizácie centrálne, čo by organizácie výrazne odbremenilo a pravdepodobne by sa podarilo vyrokovať nižšie ceny na poistné zmluvy od jedného dodávateľa, pre väčšie množstvo prístrojov. Okrem toho chýbajú z pozície P SAV aj ďalšie aktivity v rovine všeobecných usmernení, napr. usmernenia a prípadné školenia ako postupovať pri aplikácii elektronického trhoviska.

Iným príkladom absurdnej administratívnej povinnosti je sledovanie výdavkov na nákup výpočtovej techniky v samostatnej kapitole. Výsledkom je požiadavka presne definovať sumu vyčlenenú na túto aktivitu s tým, že akékoľvek schvalovanie trvá 2-3 mesiace! To znamená, že posledný nákup z projektov môže byť realizovaný možno v septembri, aby sa stihol celý schvaľovací proces.

Ďalším problémom presahujúcim možnosti riešenia jednotlivých organizácií, je prístup agentúry APVV k otázke čerpania nepriamych nákladov. Tento prístup zásadným spôsobom obmedzuje fungovanie organizácie, pričom jednostranná interpretácia zákona zo strany APVV nie je konfrontovaná iným nezávislým zdrojom.

Treba spomenúť aj problematiku ohľadne GDPR. Zavedenie tejto smernice komplikuje fungovanie ústavu na všetkých úrovniach od napr. organizovania konferencií, cez používanie výpočtovej techniky, až po napr. zverejňovanie telefónnych čísel na webe. Problémy spojené s touto problematikou ochromujú v mnohých oblastiach fungovanie vedeckej inštitúcie. P SAV bolo v riešení problému ústretové a zorganizovalo príslušné školenia ako aj kontakt s firmami, ktoré môžu jednotlivým organizáciám pomôcť pri riešení obrovského počtu problémov. Prihovárame sa, aby v tejto ústretovosti P SAV (alebo úrad SAV) pokračovali a ponúkli pre organizácie aspoň základné vzorové smernice alebo dokumenty, napr. vzorovú pracovnú zmluvu alebo vzorovú smernicu o používaní IT technológií (a mnohé iné). Bude určite lacnejšie, ak takéto dokumenty budú vypracované iba raz pre všetky organizácie oproti situácii, keď si takéto dokumenty/smernice dajú vypracovať organizácie jednotlivo.

Samostatnou kapitolou bola transformácia/netransformácia organizácií na v.v.i. v roku 2018. Ako zásadný problém celej tejto aktivity považujeme absolútne nekompetentný a netransparentný prístup Ministerstva školstva, vedy, výskumu a športu SR. Nekompetentný prístup spočíva v svojoľnom výklade príslušných zákonov zo strany ministerstva bez akejkoľvek právnej, logickej a dokonca aj etickej podpory. Inými slovami, ministerstvo si zo zamestnancov SAV počas dva a pol mesiaca urobilo trhací kalendár. Navyše, celá transformácia bola postavená aj do politického kontextu so známkami protiústavnosti. Netransparentnosť spočíva v ignorantnom postoji ministerstva školstva a zákernosti verejných vystúpení. Detaily netreba na tomto mieste vymenúvať, sú zdokumentované v listinnej podobe od komunikácie ministerstva školstva so SAV, cez rokovania v parlamente a príslušných orgánov až po vystúpenia v médiách. Čerešničkou na torte bola kolaborácia odborového predáka SAV s ministerstvom školstva pri organizovaní zmarenia transformácie organizácií SAV na v.v.i. organizácie.

**Správu o činnosti organizácie SAV spracoval(i):**

doc. Ing. Zoltán Lenčoš, PhD., 02/59410408

Ing. Helena Pálková, PhD., 02/59410485

**Riaditeľ organizácie SAV**

**Predseda vedeckej rady**

.....  
doc. Ing. Miroslav Boča, DrSc.

.....  
RNDr. Jana Madejová, DrSc.

## Prílohy

### Príloha A - Zoznam zamestnancov a doktorandov organizácie k 31.12.2018

#### Zoznam zamestnancov podľa štruktúry (nadväzne na údaje v Tabuľke 1a)

Meno s titulmi	Úväzok (v %)	Ročný prepočítaný úväzok
<b>Vedúci vedeckí pracovníci DrSc.</b>		
1. doc. Ing. Miroslav Boča, DrSc.	100	1.00
2. prof. RNDr. Juraj Bujdák, DrSc.	50	0.50
3. prof. Ing. Dušan Galusek, DrSc.	55	0.55
4. prof. Ing. Marek Liška, DrSc.	45	0.45
5. RNDr. Jana Madejová, DrSc.	100	1.00
6. Dr. Oľga Malkin, DrSc.	100	1.00
7. Dr. Vladimír Malkin, DrSc.	100	1.00
8. prof. RNDr. Jozef Noga, DrSc.	53	0.53
9. prof. RNDr. Pavol Šajgalík, DrSc.	55	0.55
<b>Samostatní vedeckí pracovníci</b>		
1. doc. Ing. Tomáš Bučko, PhD.	25	0.25
2. Mgr. Adriana Czímerová, PhD.	100	1.00
3. doc. Ing. Miroslav Hnatko, PhD.	100	1.00
4. Ing. Mária Chromčíková, PhD.	100	1.00
5. Mgr. Ľuboš Jankovič, PhD.	100	1.00
6. Mgr. Stanislav Kedžuch, PhD.	100	1.00
7. Mgr. Stanislav Komorovský, PhD.	100	1.00
8. Ing. Michal Korenko, PhD.	100	1.00
9. Ing. Blanka Kubíková, PhD.	100	1.00
10. doc. Ing. Zoltán Lenčes, PhD.	100	1.00
11. Ing. Helena Pálková, PhD.	100	1.00
12. Ing. Viliam Pavlík, PhD.	100	1.00
13. Ing. Anna Prnová, PhD.	100	1.00
14. Ing. Jaroslav Sedláček, PhD.	100	1.00
15. Ing. Eva Scholtzová, CSc.	100	1.00
16. Ing. František Šimko, PhD.	100	1.00
17. Mgr. Peter Švančárek, PhD.	100	1.00
18. Ing. Peter Tatarko, PhD.	100	1.00

19.	Mgr. Monika Tatarková, PhD.	100	0.33
20.	Ing. Štefan Varga, CSc.	100	1.00
<b>Vedeckí pracovníci</b>			
1.	James Richard Asher, PhD	100	1.00
2.	Mgr. Silvia Belušáková, PhD.	100	1.00
3.	Mgr. Peter Boháč, PhD.	100	0.00
4.	Mgr. Roman Bystrický, PhD.	120	1.20
5.	Ing. Ondrej Hanzel, PhD.	100	1.00
6.	Mgr. Valéria Kureková, PhD.	100	1.00
7.	Ing. Monika Micháľková, PhD.	100	1.00
8.	Ing. Jarmila Mlynáriková, PhD.	100	1.00
9.	Ing. Zuzana Netriová, PhD.	100	1.00
10.	Dr. Mohamed Radwan	100	1.00
11.	Ing. Peter Škorňa, PhD.	100	1.00
12.	Ing. Jana Valúchová, PhD.	100	1.00
13.	Ing. Zuzana Vasková, PhD.	100	0.00
<b>Odborní pracovníci s VŠ vzdelaním (výskumní a vývojoví zamestnanci)</b>			
1.	Hesham Abdelrehim, Dr.	100	1.00
2.	Ing. Eva Hadzimová	100	0.00
3.	Ing. Iveta Macková	100	1.00
4.	Ing. Eva Mikšíková	125	1.25
5.	Ing. Jozef Priščák	100	1.00
6.	Ing. Michal Slaný	100	0.33
7.	Mgr. Pavol Weiner	100	1.00
<b>Odborní pracovníci s VŠ vzdelaním (ostatní zamestnanci)</b>			
1.	Mgr. Miroslav Adámek	50	0.37
2.	Rastislav Haška	100	1.00
3.	Ing. Ingrid Hierwegová	5	0.05
4.	Ing. Ján Piško	100	1.00
5.	Ing. Jaroslav Rusnák, PhD.	33	0.33
6.	JUDr. Bc. Marica Slaná	100	1.00
<b>Odborní pracovníci ÚSV</b>			
1.	Miroslav Baďura	20	0.20
2.	Iveta Bouadjenak	100	1.00
3.	Slavomír Daniš	100	0.75



4.	Jaromíra Dankovičová	125	1.25
5.	Jarmila Heinleinová	100	1.00
6.	Miriám Hnatková	100	0.33
7.	Anna Jurová	100	1.00
8.	Magdaléna Kňazovičová	100	1.00
9.	Anna Kovárová	100	1.00
10.	Mária Strempeková	100	1.00
11.	Alexandra Tonkovičová	100	1.00
<b>Ostatní pracovníci</b>			
1.	Margita Hudáková	100	1.00
2.	Terézia Pírová	100	1.00

**Zoznam zamestnancov, ktorí odišli v priebehu roka**

	<b>Meno s titulmi</b>	<b>Dátum odchodu</b>	<b>Ročný prepočítaný úväzok</b>
<b>Vedúci vedeckí pracovníci DrSc.</b>			
1.	RNDr. Peter Komadel, DrSc.	17.12.2018	1.00
<b>Samostatní vedeckí pracovníci</b>			
1.	Mgr. Stanislav Komorovský, PhD.	31.12.2018	1.00
<b>Vedeckí pracovníci</b>			
1.	Mgr. Alexander Čeklovský, PhD.	31.8.2018	0.66
2.	Ing. Martin Kontrík, PhD.	30.11.2018	0.91
3.	Dr. Niketan Patel Sarabhai	30.6.2018	0.50
<b>Odborní pracovníci s VŠ vzdelaním (ostatní zamestnanci)</b>			
1.	JUDr. Jana Šebová	28.2.2018	0.16
<b>Odborní pracovníci ÚSV</b>			
1.	Zora Lukáčová	30.12.2018	1.00
2.	Jozef Sitár	20.9.2018	0.75

**Zoznam doktorandov**

	<b>Meno s titulmi</b>	<b>Škola/fakulta</b>	<b>Študijný odbor</b>
<b>Interní doktorandi hrazení z prostriedkov SAV</b>			
1.	Ing. Martin Barlog	Slovenská technická univerzita v Bratislave	5.2.19 anorganická technológia a materiály
2.	Ing. Zuzana Fördösová	Slovenská technická univerzita v Bratislave	5.2.19 anorganická technológia a materiály
3.	Ing. Michal Hičák	Prírodovedecká fakulta UK	4.1.15 anorganická chémia
4.	Ing. Stanislav Mikušínek	Slovenská technická	5.2.19 anorganická technológia a

		univerzita v Bratislave	materiály
5.	Daniel Moreno Rodriguez	Slovenská technická univerzita v Bratislave	5.2.19 anorganická technológia a materiály
6.	Mgr. Patrícia Petrisková	Univerzita Komenského v Bratislave	4.1.15 anorganická chémia
7.	Ing. Michal Slaný	Fakulta chemickej a potravinárskej technológie STU	5.2.19 anorganická technológia a materiály
8.	MSc. Hakan Ünsal	Univerzita Komenského v Bratislave	4.1.15 anorganická chémia

**Interní doktorandi hrazení z iných zdrojov**

*organizácia nemá interných doktorandov hrazených z iných zdrojov*

**Externí doktorandi**

*organizácia nemá externých doktorandov*

**Zoznam zamestnancov prijatých do jedného roka od získania PhD.****Meno s titulmi****Dátum obhajoby****Dátum prijatia****Úväzok  
(v %)****Zoznam emeritných vedeckých zamestnancov****Meno s titulmi**

**Príloha B - Projekty riešené v organizácii****Medzinárodné projekty****Programy: Medziakademická dohoda (MAD)****1.) Využitie organo-modifikovaných vrstevnatých silikátov ako nosičov nanočastíc kovov**  
(*Immobilization of metal nanoparticles on organo-modified layered silicates*)

<b>Zodpovedný riešiteľ:</b>	Helena Pálková
<b>Trvanie projektu:</b>	1.1.2016 / 31.12.2018
<b>Evidenčné číslo projektu:</b>	MAD 12/2016
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	1 - Poľsko: 1
<b>Čerpané financie:</b>	-

**Dosiahnuté výsledky:**

Dva typy ílových minerálov: prírodný di-oktaédrický montmorillonit Kunipia a syntetický tri-oktaédrický Laponite RD sa použili na prípravu nosičov nanočastíc striebra Ag<sup>0</sup>. Syntéza sa uskutočnila v dvoch stupňoch, a to modifikáciou ílových minerálov s kationovým polymérom - polydiallyldimetylamóniový kation (PDDA). PDDA plnilo úlohu stabilizátora častíc Ag<sup>0</sup>. V druhom ktorku sa uskutočnila redukcia striebra z Ag<sup>+</sup> na Ag<sup>0</sup>. Cieľom bolo preskúmať antibakteriálne vlastnosti kompozitných materiálov na báze organomodifikovaných ílových minerálov s imobilizovanými Ag nanočasticami. Uskutočnili sa testy na antibakteriálnu aktivitu použitím mikroorganizmov *Staphylococcus aureus*. Výsledky ukázali úplnú inhibíciu tvorby biofilmu pri vzorkách pripravených rovnakým postupom. Vplyv prípravy vzoriek na pozorované vlastnosti je predmetom ďalšieho skúmania.

**Výstupy:**

SERWICKA, Ewa M. - ZIMOWSKA, Malgorzata - DURACZYNSKA, Dorota - NAPRUSZEWSKA, Bogna D. - NATTICH-RAK, Malgorzata - MORDARSKI, Grzegorz - LITYNSKA-DOBRZYNSKA, L. - PÁLKOVÁ, Helena. PDDA-montmorillonite composites loaded with Ru nanoparticles: Synthesis, characterization, and catalytic properties in hydrogenation of 2-butanone. In POLYMERS-BASEL, 2018, vol. 10, iss. 8, p. 865-879. (2.935 - IF2017).

**Príspevky na konferenciách:**

PÁLKOVÁ, Helena - ZIMOWSKA, Malgorzata - JANKOVIČ, Ľuboš - BUJDÁKOVÁ, Helena. Immobilization of metal nanoparticles on organo-modified layered silicates. In Clay minerals and selected non-raw materials in material science, industrial applications and environmental technology: Book of abstracts, 5th Workshop of Slovak Clay Group, May 21-23, 2018, Banská Štiavnica, Slovakia. Slovak Clay Group, Dúbravská cesta 9, Bratislava, 2018, p. 21.

ZIMOWSKA, Malgorzata - PÁLKOVÁ, Helena - MADEJOVÁ, Jana - SOCHA, Robert P. FTIR spectroscopy to study formation and functionalisation of porous clay heterostructures derived from laponite. In 55th annual meeting - The Clay Minerals Society. University of Illinois at Urbana-Champaign, Illinois, USA, June 11-14, 2018 program & abstracts p. 268.

**2.) Vývoj nových pokročilých keramických kompozitov pre vesmírne aplikácie** (*Development of new advanced ceramic composites for aerospace industry*)

<b>Zodpovedný riešiteľ:</b>	Peter Tatarko
<b>Trvanie projektu:</b>	1.1.2018 / 31.12.2020
<b>Evidenčné číslo projektu:</b>	2/0116/17
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	1 - Česko: 1
<b>Čerpané financie:</b>	-

**Dosiahnuté výsledky:**

V súlade s plánom projektu bol prvý rok venovaný optimalizácií prípravy nových vysokoteplotných keramických materiálov, na báze ZrB<sub>2</sub>-SiC a ZrB<sub>2</sub>-SiC-Lu<sub>2</sub>O<sub>3</sub>. Hutné materiály boli získané spekaním práškových zmesí za asistencie

elektrického prúdu pomocou zariadenia "Direct Hot Press", pri podmienkach 2000-2100°C a tlaku 70-90MPa. Vyspekané hutné vzorky boli opracované a pripravené na jednotlivé skúšanie mechanických vlastností na ÚFM AVČR. Bolo preukázané, že pridaním prísady  $\text{Lu}_2\text{O}_3$  došlo napriek miernemu poklesu tvrdosti materiálov k zlepšeniu lomovej húževnatosti, modulu pružnosti a pevnosti, pričom hodnoty týchto vlastností sa zvyšovali so zvyšujúcim sa množstvom prísady  $\text{Lu}_2\text{O}_3$ .

V rámci projektu sa tiež podarilo pripraviť nové keramické peny na báze  $\text{Al}_2\text{O}_3/\text{SiO}_2/\text{CaO}$ , ktorých výroba je šetrná k životnému prostrediu. Penové vzorky boli pripravené z práškov Al a  $\text{Ca}(\text{OH})_2$  na ÚFM AVČR, pričom k ich konvertovaniu na finálne keramické zloženie došlo voľným spekaním v grafitovej peci na ÚACh SAV. Takto pripravené materiály boli potom charakterizované z hľadiska mikroštruktúry, fázového zloženia, pevnosti v tlaku (všetko ÚFM AVČR), a tepelnej difúzivity (ÚACh SAV).

#### Publikácie:

1. BERTOLLA, Luca - CHLUP, Zdeněk - TATARKO, Peter - HANZEL, Ondrej - ŠEVEČEK, Oldřich - ROUPCOVÁ, Pavla - DLOUHÝ, Ivo. Preparation and characterization of novel environmentally friendly  $\text{Al}_2\text{O}_3/\text{SiO}_2/\text{CaO}$  ceramic foams. In *Ceramics International*, 2018, vol. 44, p. 19063-19069. (3.057 - IF2017). ISSN 0272-8842.
2. FÜRDÖSOVÁ, Zuzana - DLOUHÝ, Ivo - TATARKO, Peter. Preparation and characterization of  $\text{ZrB}_2\text{-SiC}$  based ultra high temperature ceramics = Príprava a charakterizácia vysokoteplotnej keramiky na báze  $\text{ZrB}_2\text{-SiC}$ . In *Processing and properties of advanced ceramics and glasses*, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : conference proceedings. Eds. Erika Múdra, Alexandra Kovalčíková. - Košice, Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 98-103. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials).
3. TATARKO, Peter - ZHOU, Xiaobing - GRASSO, Salvatore - DLOUHÝ, Ivo - FERRARIS, Monica. Electric field assisted joining of advanced  $\text{SiC}$ -based ceramics. In *Processing and properties of advanced ceramics and glasses*, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : conference proceedings. - Košice, Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 138-139. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials).

#### Programy: COST

##### 3.) Naša história z astrochémie (*Our Astro-Chemical History*)

<b>Zodpovedný riešiteľ:</b>	Jozef Noga
<b>Trvanie projektu:</b>	26.11.2014 / 25.11.2018
<b>Evidenčné číslo projektu:</b>	CMST COST Action CM1401
<b>Organizácia je koordinátorom projektu:</b>	nie
<b>Koordinátor:</b>	Institut de Planétologie et d'Astrophysique de Grenoble
<b>Počet spoluriešiteľských inštitúcií:</b>	9 - Rakúsko: 1, Česko: 1, Nemecko: 1, Dánsko: 1, Fínsko: 1, Maďarsko: 1, Írsko: 1, Taliansko: 1, Holandsko: 1
<b>Čerpané financie:</b>	Podpora medzinárodnej spolupráce z národných zdrojov: 4107 €

#### Dosiahnuté výsledky:

Programom DIRCCR120S vyvíjaným v našej skupine boli napočítané vysokopresné potenciálové hyperplochy systémov zaujímavých z hľadiska astrochémie. Momentálne v spolupráci s profesorom Ad van der Avoird (Radboud University, Nijmegen, Holandsko) pracujeme na fitovaní a analýze daných hyperplôch na získanie dynamických parametrov potrebných na interpretáciu experimentálne získaných dát v astrofyzike.

#### Programy: Multilaterálne - iné

**4.) Relativistické efekty v molekulových materiáloch založených na komplexoch zlata: katalytická aktivita, prenos protónov a NMR vlastnosti** (*Relativistic effects in molecular materials based on gold complexes: catalytic activity, proton transfer, and NMR properties*)

**Zodpovedný riešiteľ:** Oľga Malkin  
**Trvanie projektu:** 1.1.2017 / 31.12.2018  
**Evidenčné číslo projektu:**  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 2 - Rakúsko: 1, Česko: 1  
**Čerpané financie:** Podpora medzinárodnej spolupráce z národných zdrojov: 1802 €

Dosiahnuté výsledky:

Jan Vícha, Stanislav Komorovsky, Michal Repisky, Radek Marek, and Michal Straka, J. Chem. Theory Comput. 2018, 14, 3025-3039

Pankaj L. Bora, Jan Novotný, Kenneth Ruud, Stanislav Komorovsky, and Radek Marek, J. Chem. Theory Comput. 2019, 15, 1, 201-214

**Programy: Bilaterálne - iné**

**5.) Vývoj a charakterizácia nových povlakov na báze sklo/keramika pre vysokoteplotné aplikácie**  
*(Development and characterization of a novel glass/ceramic coating systems for high temperature applications)*

**Zodpovedný riešiteľ:** Dušan Galusek  
**Trvanie projektu:** 1.1.2018 / 31.12.2019  
**Evidenčné číslo projektu:**  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Universität Bayreuth  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** -

Dosiahnuté výsledky:

V rámci tohto mobilitného projektu 2 mladí vedeckí pracovníci do 35 rokov zo spoločného pracoviska UACH SAV a TNUAD, Centra kompetencie pre výskum skla Vitrum Laugaricio v Trenčíne absolvovali výskumnú stáž na Universität Bayreuth v Nemecku. Najdôležitejšími výstupmi týchto stáží sú:

- Optimalizácia procesu čistenia ocelového substrátu pre nanášanie antikorózných vrstiev,
- Optimalizácia procesu nanášania týchto vrstiev metódou spray coating, ktorá na materskom pracovisku nie je k dispozícii,
- Príprava povlakovaných ocelí pre vykonanie korózných a vysokoteplotných oxidačných testov na materskom pracovisku.

**6.) Spájanie moderných keramických materiálov na báze SiC** *(Joining of advanced SiC-based ceramic materials)*

**Zodpovedný riešiteľ:** Peter Tatarko  
**Trvanie projektu:** 1.1.2018 / 31.12.2019  
**Evidenčné číslo projektu:** SK-CN-2017-0040  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** Podpora medzinárodnej spolupráce z národných zdrojov: 2127 €

Dosiahnuté výsledky:

V súlade s plánom projektu boli pripravené vstupné SiC materiály, ktoré ďalej slúžia ako substráty pre spájanie. Zároveň boli pripravené aj spojovacie materiály vo forme pások  $\text{Ti}_3\text{SiC}_2$ , predspekanej fólie na báze  $\text{Ti}_3\text{SiC}_2$ , ako aj nanosenia vrstvy Ti metódou PVD na vyleštený povrch SiC materiálov. Následne bolo metódou spájania za asistencie elektrického prúdu pripravených niekoľko druhov spojov, pričom najlepšie podmienky prípravy spojov, t.j. teplota, tlak, a doba výdrže na maximálnej teplote boli stanovené na základe mikroštruktúrnych analýz a mechanických vlastností

(pevnosti spojov). Pevnosť za vysokých teplôt, ako aj odolnosť proti tepelným šokom vybraných spojov bude študovaná v nasledujúcej etape riešenia projektu.

1. FÜRDÖSOVÁ, Zuzana - DLOUHÝ, Ivo - TATARKO, Peter. Preparation and characterization of ZrB<sub>2</sub>-SiC based ultra high temperature ceramics = Příprava a charakterizácia vysokoteplotnej keramiky na báze ZrB<sub>2</sub>-SiC. In Processing and properties of advanced ceramics and glasses, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : conference proceedings. Eds. Erika Múdra, Alexandra Kovalčíková. - Košice, Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 98-103. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials).
2. TATARKO, Peter - ZHOU, Xiaobing - GRASSO, Salvatore - DLOUHÝ, Ivo - FERRARIS, Monica. Electric field assisted joining of advanced SiC-based ceramics. In Processing and properties of advanced ceramics and glasses, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : conference proceedings. Košice, Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 138-139. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials).

**7.) Vývoj nových vysokoteplotných kompozitných materiálov s keramikou maticou so zvýšenou oxidačnou/ablačnou odolnosťou pre vesmírne aplikácie** (*Development of new ultra-high temperature ceramic matrix composites with improved oxidatio/ablation properties for aerospace industry*)

<b>Zodpovedný riešiteľ:</b>	Peter Tatarko
<b>Trvanie projektu:</b>	1.11.2017 / 31.10.2020
<b>Evidenčné číslo projektu:</b>	MVTS 41090027
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	-
	Podpora medzinárodnej spolupráce z národných zdrojov:
	24000 €

Dosiahnuté výsledky:

Riešenie projektu bolo zamerané na vývoj novej diboridovej keramiky na báze ZrB<sub>2</sub>-SiC, pričom pomerne veľké úsilie bolo venované podrobnému štúdiu vplyvu rôznych parametrov planétového mletia na homogenitu, kontamináciu, a veľkosť častíc keramikých práškových zmesí. Hutné keramiké materiály boli pripravené spekaním práškových zmesí za asistencie elektrického prúdu pomocou zariadenia "Direct Hot Press", pri podmienkach 2000-2100°C a tlaku 70-90MPa. Vykonala sa podrobná chemická a fázová analýza, mikroštruktúrna analýza, ako aj hodnotenie mechanických vlastností, t.j. tvrdosti, Youngovho modulu pružnosti, lomovej húževnatosti a pevnosti. Po vyhodnotení výsledkov sa režim homogenizácie pri podmienkach 150rpm a 7h ukázal ako priaznivejší pre prípravu kompozitných materiálov. Takýmto spôsobom boli pripravené práškové zmesi, ktoré boli následne nanášané na vyleštený povrch CVD-SiC materiálov metódou „aerosol deposition“. Bol úspešne vytvorený súvislý, homogénny povlak s mikroštruktúrou ZrB<sub>2</sub>-SiC s hrúbkou vrstvy od 1 do 22 µm. V ďalšom kroku bude proces nanášania ďalej optimalizovaný za účelom zníženia zostatkovej nanometrickej pórovitosti, ako aj pre zmes práškov ZrB<sub>2</sub>-SiC s prídavkom oxidov prvkov vzácných zemín (napr. Lu<sub>2</sub>O<sub>3</sub>).

Publikácie:

1. BERTOLLA, Luca - CHLUP, Zdeněk - TATARKO, Peter - HANZEL, Ondrej - ŠEVEČEK, Oldřich - ROUPCOVÁ, Pavla - DLOUHÝ, Ivo. Preparation and characterization of novel environmentally friendly Al<sub>2</sub>O<sub>3</sub>/SiO<sub>2</sub>/CaO ceramic foams. In Ceramics International, 2018, vol. 44, p. 19063-19069. (3.057 - IF2017). ISSN 0272-8842.
2. FÜRDÖSOVÁ, Zuzana - DLOUHÝ, Ivo - TATARKO, Peter. Preparation and characterization of ZrB<sub>2</sub>-SiC based ultra high temperature ceramics = Příprava a charakterizácia vysokoteplotnej keramiky na báze ZrB<sub>2</sub>-SiC. In Processing and properties of advanced ceramics and glasses, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : conference proceedings. Eds. Erika Múdra, Alexandra Kovalčíková. - Košice, Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 98-103. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials).
3. TATARKO, Peter - GRASSO, Salvatore - SAUNDERS, Theo G. - CASALEGNO, Valentina - FERRARIS, Monica

- REECE, Michael J. Electric current assisted joining of SiC-based ceramic matrix composites. In ICACC 2018. 42nd International conference & exposition on advanced ceramics and composites, January 21-26, 2018, Daytona Beach, Florida, USA: abstract book. USA: The American Ceramic Society, 2018, p. 35. (ICACC 2018. International Conference & Exposition on Advanced Ceramics and Composites).
4. TATARKO, Peter - ZHOU, Xiaobing - GRASSO, Salvatore - DLOUHÝ, Ivo - FERRARIS, Monica. Electric field assisted joining of advanced SiC-based ceramics. In Processing and properties of advanced ceramics and glasses, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : conference proceedings. - Košice, Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 138-139. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials).

## Programy: ERANET

### 8.) Multifunkčné hrubé povlaky keramik-grafén pre perspektívne aplikácie (*Multifunctional ceramic/graphene thick coatings for new emerging applications*)

<b>Zodpovedný riešiteľ:</b>	Zoltán Lenčేశ
<b>Trvanie projektu:</b>	1.1.2018 / 31.12.2020
<b>Evidenčné číslo projektu:</b>	
<b>Organizácia je koordinátorom projektu:</b>	nie
<b>Koordinátor:</b>	Centre for Energy Research Hungarian Academy of Sciences
<b>Počet spoluriešiteľských inštitúcií:</b>	1 - Nemecko: 1
<b>Čerpané financie:</b>	EU: 10000 €

#### Dosiahnuté výsledky:

V rámci riešenia projektu boli pripravené hutné kompozitné materiály na báze SiC so spekacími prísadami Y<sub>2</sub>O<sub>3</sub> a Al<sub>2</sub>O<sub>3</sub> a prídavkom 5, 10 a 15 hm. % grafénových nanoplátčiek a 5 hm. % oxidu grafénu. Relatívna hustota všetkých vzoriek bola vyššia ako 97 %. Na takto pripravených hutných materiáloch bola vykonaná mikroštruktúrna analýza a boli merané funkčné vlastnosti (konkrétne elektrická vodivosť a tepelná difuzivita) v rovnobežnom a kolmom smere vzhľadom na grafénové vrstvy. Bola preukázaná výrazná anizotropia funkčných vlastností ako dôsledok preferenčnej orientácie grafénových vrstiev počas spekania metódou rapid hot press. Prídavok grafénových nanoplátčiek a špeciálne oxidu grafénu viedol k výraznému nárastu elektrickej vodivosti takto pripravených kompozitov. Elektrická vodivosť v smere rovnobežnom s grafénovými vrstvami bola vyššia ako v smere kolmom na grafénové vrstvy ako dôsledok vytvorenia lepšej vodivej siete. Najvyššia hodnota elektrickej vodivosti (2031 S/m) bola dosiahnutá pri vzorke s 15 hm.% grafénových nanoplátčiek.

Tepelná difuzivita pripravených materiálov SiC-grafén bola meraná v rozsahu od RT do 500°C, zlepšenie tepelnej difuzivity sa podarilo dosiahnuť v smere rovnobežnom na grafénové vrstvy, pričom tieto pôsobili ako dodatočné fonónové dráhy. Naopak v smere kolmom na grafénové vrstvy došlo k poklesu tepelnej difuzivity v dôsledku rozhraní medzi grafénom a keramickou maticou, ktoré pôsobili ako miesta rozptylu fonónov.

Vďaka dosiahnutiu relatívne vysokej elektrickej vodivosti pri všetkých vzorkách (rádovo stovky S/m a viac) boli taktiež elektroiskrovo obrábané a teda skúmalo sa či je možné ich efektívne obrábať touto nekonvenčnou metódou. Výsledky potvrdili, že všetky skúmané vzorky je možné elektroiskrovo obrábať a so zvyšujúcim sa obsahom grafénu rýchlosť odoberania materiálu vzrástá z 5 mg/min (pre vzorku s 5 % grafénových nanoplátčiek) až na 9 mg/min (pre vzorku s 15 % grafénových nanoplátčiek). Zároveň drsnosť povrchu po obrobení klesala s rastúcim obsahom grafénu a teda aj s rastúcou elektrickou vodivosťou až na hodnotu 1,5 µm. Týmto spôsobom je teda možné pripraviť materiály SiC-grafén, ktoré je možné elektroiskrovo obrábať aj s požadovanou drsnosťou povrchu po obrobení.

#### Publikácie:

SINGH, Meinam Annebushan - SARMA, Deba Kumar - HANZEL, Ondrej - SEDLÁČEK, Jaroslav - ŠAJGALÍK, Pavol. Surface characteristics and erosion phenomena in WEDM of alumina composites. In Materials and Manufacturing Processes, 2018, vol. 33, no. 16, p. 1815-1821. (2.669 - IF2017). ISSN 1042-6914. Typ: ADCA

HANZEL, Ondrej - LENČEŠ, Zoltán - KIM, Young-Wook - ŠAJGALÍK, Pavol. SiC-graphene composites with high thermal and electrical conductivity. In ISIEM 2018: International Symposium on Inorganic and Environmental Materials 2018, June 17-21 2018, Het Pand-Ghent (Belgium), 1 p. - COM-L2.(ISIEM 2018). Typ: AFG

HANZEL, Ondrej - SEDLÁK, Richard - SEDLÁČEK, Jaroslav - KOVALČÍKOVÁ, Alexandra - DUSZA, Ján - ŠAJGALÍK, Pavol. Anisotropy of functional properties of SiC-graphene composites sintered by rapid hot-pressing. In 2nd Polish-Slovak-Chinese seminar on ceramics, Kraków, September 9th-13th 2018: book of abstracts, Poland: Polish Ceramic Society, 2018, p. 33. ISBN 978-83-65955-13-5. (Polish-Slovak-Chinese seminar on ceramics). Typ: AFG

HANZEL, Ondrej - LENČEŠ, Zoltán - KIM, Young-Wook - FEDOR, Ján - KONTRÍK, Martin - ŠIMKO, František - ŠAJGALÍK, Pavol. Kompozity SiC - grafén s vysokou elektrickou a tepelnou vodivosťou, ich korózná odolnosť voči fluoridovým taveninám = Silicon carbide - Graphene composites with high electrical and thermal conductivity, their corrosion resistance against fluoride melts. In Interakcie tavenín s progresívnymi anorganickými materiálmi. 9. odborný seminár. 15. - 16. október 2018, Borinka. Ed. František Šimko, recenzent Pavel Fellner. Bratislava: Ústav anorganickej chémie SAV, 2018, p. 114-122. ISBN 978-80-971648-6-7. (Interakcie tavenín s progresívnymi anorganickými materiálmi). Typ: AFD

HANZEL, Ondrej - LENČEŠ, Zoltán - KIM, Young-Wook - ŠAJGALÍK, Pavol. SiC-graphene composites with high electrical and thermal conductivity = Kompozitné materiály SiC-grafén s vysokou elektrickou a tepelnou vodivosťou. In Processing and properties of advanced ceramics and glasses, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : Conference proceedings. Eds. Erika Múdra, Alexandra Kovalčíková. Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 7-11. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials). Typ: AFD

HANZEL, Ondrej - LENČEŠ, Zoltán - KIM, Young-Wook - ŠAJGALÍK, Pavol. SiC-graphene composites with high electrical and thermal conductivity. In Processing and properties of advanced ceramics and glasses, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018: Conference proceedings. Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 143. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials). Typ: AFH

## Programy: Horizont 2020

### 9.) New Generation Ultra-High Temperature Ceramic Matrix Composites for Aerospace Industry (New Generation Ultra-High Temperature Ceramic Matrix Composites for Aerospace Industry)

<b>Zodpovedný riešiteľ:</b>	Peter Tatarko
<b>Trvanie projektu:</b>	1.6.2018 / 31.5.2020
<b>Evidenčné číslo projektu:</b>	MSCA-IF-2017, grant agreement: 798651
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	1 - Nemecko: 1
<b>Čerpané financie:</b>	EU: 37991 €

#### Dosiahnuté výsledky:

V úvodnej etape riešenia projektu boli získané 4 rôzne druhy kompozitov s keramickou maticou  $C_f/SiC$  od priemyselného partnera projektu, Airbus Defence & Space. Tie sa líšili pórovitosťou, spôsobom výroby a obsahom ďalších prísad ( $ZrB_2$  + TaC) v SiC kompozitoch spevnených uhlíkovými vláknami  $C_f$ . Homogenizáciou a následným izostatickým lisovaním práškov za studena ( $ZrSi_2$  a  $HfSi_2$ ) boli pripravené vzorky ( $\varnothing 4 \times 1.5$  mm). Takto pripravené „green-body“ pelety boli potom využité pre štúdium zmáčanlivosti povrchu CVD-SiC materiálov a  $C_f/SiC$  kompozitov. Prvotné výsledky preukázali, že tavenie silicidov ( $ZrSi_2$  a  $HfSi_2$ ), ako aj ich zmáčanlivosť na povrchu CVD-SiC a  $C_f/SiC$  je výrazne zlepšená pri použití argónovej atmosféry, pri porovnaní s vákuom. Z týchto dôvodov sa v ďalších experimentoch súvisiacich s prípravou povrchovej vrstvy bude uvažovať len s argónovou atmosférou. V ďalšom kroku sa bude študovať zmáčanlivosť komplexných práškových zmesí ( $ZrSi_2-B_4C-C$ -vzácná zemina a  $HfSi_2-B_4C-C$ -vzácná zemina), pričom poznatky budú prenesené do vývoja vhodnej metodiky prípravy povrchovej vrstvy na povrchu  $C_f/SiC$  kompozitov.

## Programy: JRP

### 10.) Transparentná oxidová keramika s dodatočnými optickými funkcionalitami (Transparent oxide ceramics with additional optical functionalities)

<b>Zodpovedný riešiteľ:</b>	Dušan Galusek
<b>Trvanie projektu:</b>	1.1.2016 / 31.12.2018
<b>Evidenčné číslo projektu:</b>	SAS - MOST JRP 2015/06
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	1 - Taiwan: 1
<b>Čerpané financie:</b>	Podpora medzinárodnej spolupráce z národných zdrojov:



24998 €

Dosiahnuté výsledky:

Dosiahnuté výsledky: V rámci projektu sa podarilo pripraviť niekoľko typov transparentných a translucenčných polykryštalických keramických materiálov. Horečnato-hlinitý spinel  $\text{MgAl}_2\text{O}_4$  spinel je zaujímavým materiálom vhodným pre optické aplikácie, ako sú hostiteľské materiály pre lasery. Keďže spinel má kubickú kryštalovú mriežku, je možné z neho pripraviť transparentný polykryštalický materiál úplnou elimináciou zvyškovej pórovitosti. Vo väčšine prípadov je však na prípravu takéhoto materiálu potrebná pomerne náročná príprava bezdefektného a vysoko hutného surového kompaktu s následnou aplikáciou vysokého tlaku a teploty, napríklad pomocou žiarového izostatického lisovania. V rámci projektu SAS-MOST JRP2015/6 sa vyvinula technológia prípravy vysoko transparentného polykryštalického spinelu jednodušnou technológiou priameho zhutňovania komerčného spinelového prášku a prášku dopovaného Mn-iónmi pomocou metódy SPS.

## Publikácie:

1. Anna Prnová, Alfonz Plško, Jana Valúchová, Katarína Haladejová, Róbert Klement, Dušan Galusek; Crystallization kinetics of glass microspheres with yttrium aluminium garnet (YAG) composition; ISSN 1388-6150, Volume 131, Number 2, J Therm Anal Calorim (2018), 131:1115-1123, DOI 10.1007/s10973-017-6690-9
2. Anna Prnová, Alfonz Plško, Jana Valúchová, Peter Švančárek, Robert Klement Monika Micháliková, Dušan Galusek; Crystallization kinetics of yttrium aluminate glasses; Journal of Thermal Analysis and Calorimetry; ISSN: 1388-6150, Vol 133, Number 1, p. 227-236, DOI: 10.1007/s10973-017-6948-2

**Domáce projekty****Programy: VEGA****1.) Roztavené fluoridové systémy s vyššou funkcionalitou** (*Molten fluoride systems with higher functionality*)**Zodpovedný riešiteľ:**

Miroslav Boča

**Trvanie projektu:**

1.1.2016 / 31.12.2019

**Evidenčné číslo projektu:**

2/0114/16

**Organizácia je koordinátorom projektu:**

áno

**Koordinátor:**

Ústav anorganickej chémie SAV

**Počet spoluriešiteľských inštitúcií:**

0

**Čerpané financie:**

SAV: 16800 €

Dosiahnuté výsledky:

Uskutočnená komplexná analýza roztaveného systému  $(\text{LiF-NaF})_{\text{eut}}\text{-LaF}_3$ , ktorá zahrňovala meranie fázových rovnováh, hustoty, elektrickej vodivosti a povrchového napätia. Fázové rovnováhy boli študované metódou termickej analýzy. Keďže skúmaný systém je rezom štvorzložkovej sústavy, fázový diagram je tvorený viacerými kryštalizačnými poliami, ktoré sú ohraňované teplotami primárnej kryštalizácie, eutektickou teplotou a teplotami sekundárnej kryštalizácie. Na stanovenie hustoty sa využila Archimedova metóda. Za účelom získania koncentračnej závislosti hustoty sa z experimentálnych hodnôt hustoty pre merané zloženia vypočítala hustota pre teploty (800, 850 a 900°C) a z výsledkov vyplýva, že hustota rastie so zvyšujúcim sa obsahom  $\text{LaF}_3$  v celom študovanom rozsahu pre všetky tri zvolené teploty. Elektrická vodivosť bola študovaná metódou založenou na princípe merania fázového posunu. Elektrická vodivosť spočiatku rastie s prídavkom  $\text{LaF}_3$  do eutektickej zmesi  $\text{LiF-NaF}$ . Pri koncentrácii 2mol% dosahuje elektrická vodivosť lokálne maximum a s následným zvyšovaním obsahu  $\text{LaF}_3$ , hodnoty elektrickej vodivosti klesajú. Metóda maximálneho tlaku bublinky sa využila pre stanovenie povrchového napätia. Koncentračná závislosť je znázornená na obrázku 5. Povrchové napätie má stúpajúcu tendenciu v študovanom koncentračnom rozsahu, pričom k najvýraznejším zmenám dochádza v rozmedzí 5-10mol%  $\text{LaF}_3$ .

Publikácie a príspevky:

KUBÍKOVÁ, Blanka - MLYNÁRIKOVÁ, Jarmila - BENEŠ, Ondřej - MIKŠÍKOVÁ, Eva - PRIŠČÁK, Jozef - TOSOLIN, Alberto - BOČA, Miroslav. Physico-chemical properties of the system  $(\text{LiF-NaF})_{\text{eut}}\text{-LaF}_3$  - Phase equilibria, density and volume properties, electrical conductivity and surface tension. In Journal of Molecular Liquids, 2018, vol. 268, p. 754-761. (4.513 - IF2017). (2018 - Current Contents, WOS, SCOPUS). ISSN 0167-7322.

KUBÍKOVÁ, Blanka - MLYNÁRIKOVÁ, Jarmila - MIKŠÍKOVÁ, Eva - NETRIOVÁ, Zuzana - BOČA, Miroslav. Comparison of phase equilibrium and volume properties of selected fluoride molten systems based on lanthanides. In HTMC XVI. 16th IUPAC high temperature materials chemistry conference, July 2 - 6, 2018, Ekaterinburg, Russia: book of abstracts. Ekaterinburg, Russia: Ural State Pedagogical University, 2018, p. 17. ISBN 978-5-7186-1042-0. (HTMC XVI. IUPAC Conference on High Temperature Materials Chemistry).

**2.) Fotoaktívne hybridné materiály** (*Photoactive hybrid materials*)

**Zodpovedný riešiteľ:** Adriana Czímerová  
**Trvanie projektu:** 1.1.2017 / 31.12.2020  
**Evidenčné číslo projektu:** 2/0156/17  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** SAV: 5815 €

Dosiahnuté výsledky:

Počas druhého roka riešenia projektu sme sa zamerali na prípravu vodných disperzií funkčných kvantových bodiek. Pripravili sa roztoky farbív s rôznou koncentráciou, hlavne sme sa zamerali na porfyrínové farbivá. Následne sme začali s prípravou funkčných hybridných systémov ílový minerál/roztoky farbiva/disperzie kvantových bodiek. Štúdium bolo zamerané hlavne na koncentračné závislosti a kinetické meranie. Fluorescenčné spektrá vykazujú zvýšenú fluorescenčnú aktivitu pripravených hybridných supramolekulových systémov oproti samotným jednoduškovým systémom. Navyše boli pripravené prvé tenké vrstvy pomocou metódy tzv. "Langmuir-Blodgettovej techniky", kde sa študoval prenos energie medzi dvomi kationmi nasorbovanými na tenkých vrstvách ílového minerálu.

**3.) Nové anorganické fosfory na báze stechiometrických hlinitanov a kremičitanov s dlhodobou svetelnou emisiou pre optické a biomedicínske aplikácie** (*Nové anorganické fosfory na báze stechiometrických hlinitanov a kremičitanov s dlhodobou svetelnou emisiou pre optické a biomedicínske aplikácie*)

**Zodpovedný riešiteľ:** Dušan Galusek  
**Trvanie projektu:** 1.1.2018 / 31.12.2021  
**Evidenčné číslo projektu:** 1/0527/18  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Trenčianska univerzita Alexandra Dubčeka v Trenčíne  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** SAV: 3785 €

Dosiahnuté výsledky:

V rámci prvej etapy riešenia projektu bola optimalizovaná metóda prípravy nano-luminozorov na báze  $\text{SrAl}_2\text{O}_4$  dopovaného  $\text{Dy}^{3+}$ ,  $\text{Eu}^{2+}$  iónmi metódou spaľovacej syntézy; Stanovený bol optimálny pomer reaktantov (oxidačného činidla vs. redukčného činidla – močovina, kyselina citrónová) a solventu. Optimalizovanou metódou spaľovacej syntézy boli pripravené nano-luminozory s dobou dosvitu 2 a viac hodín.

**Výstupy:**

1. M. Majerová, R. Klement, A. Prnová, J. Kraxner, E. Bruneel, D. Galusek: Crystallization and visible-near-infrared luminescence of Bi-doped gehlenite glass, Roy. Soc. Open Sci. 2018, 5 (12), 181667.
2. W. Marlton, P.V. Rao, H.O. Tekin, M.I. Sayyed, R. Klement, D. Galusek, G. Lakshminarayana, P.S. Prasad, N. Veeraiah: Analysis of red mud doped  $\text{Bi}_2\text{O}_3$ - $\text{B}_2\text{O}_3$ -BaO glasses for application as glass solder in radiation shield repair using MCNPX simulation Ceram. Int. 2019; DOI: 10.1016/j.ceramint.2019.01.058

**4.) Transparentné polykryštalické keramické materiály so submikrónovou mikroštruktúrou a luminiscenčnými vlastnosťami** (*Transparent polycrystalline ceramics materials with submicron microstructure and with luminescent properties*)

**Zodpovedný riešiteľ:** Dušan Galusek  
**Trvanie projektu:** 1.1.2017 / 31.12.2020  
**Evidenčné číslo projektu:** 2/0026/17  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** SAV: 7252 €

Dosiahnuté výsledky:

V rámci projektu sa tiež skúmali možnosti prípravy transparentnej a translucetnej YAG keramiky, pričom sa použil netradičný postup prípravy spekania sklenených mikrogulôčok so zložením identickým zloženiu ytrito-hlinitého granátu, Y3Al5O12, žiarovým lisovaním, s využitím poznatkov o kinetike kryštalizácie týchto systémov získaných pomocou termoanalytických štúdií hlinitanových skiel. Pri experimentoch sa využil poznatok, že sklá spekajú viskóznym tokom v teplotnom intervale medzi teplotou skleneného prechodu, TG, a teplotou začiatku kryštalizácie. Tento interval je, vzhľadom na vysoký sklon ku kryštalizácii ytrito-hlinitanových skiel veľmi úzky (ca 52 °C) a je preto nutná dôkladná optimalizácia podmienok prípravy. Presným nastavením podmienok spekania sa podarilo pripraviť vysoko hutnú (~98 % relatívnej hustoty) a translucetnú kusovú vzorku skla so zložením Y3Al5O12 po 1 minúte spekania pri teplote nižšej ako 900 °C a pri aplikácii axiálneho mechanického tlaku 40 MPa. Vysoký sklon ku kryštalizácii pripraveného kusového skla umožňuje rýchlu transformáciu takto pripraveného materiálu na polykryštalický vysoko hutný YAG so submikrónovou veľkosťou zŕn.

### 5.) Príprava a charakterizácia granúl / mikroguličiek na báze nitridu kremičitého pre bioaplikácie (Preparation and characterization granuls/microspheres based on silicon nitride for bioapplications)

<b>Zodpovedný riešiteľ:</b>	Miroslav Hnatko
<b>Trvanie projektu:</b>	1.1.2018 / 31.12.2021
<b>Evidenčné číslo projektu:</b>	2/0152/18
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	SAV: 9692 €

Dosiahnuté výsledky:

V rámci daného obdobia boli zvládnuté dve technológie prípravy SN granúl/mikroguličiek:

1. Dávkovaním stabilnej, vodnej suspenzie do kvapalného dusíka s následnou liofilizáciou a spekaním. Dané SN granule sa vyznačujú dostatočnou manipulačnou pevnosťou a požadovanou pórovitosťou (podobnou ľudskej trabekulárnej kosti). Príprava kompozitných granúl bola dosiahnutá tlakovou infiltráciou sólu hydroxyapatitu do ich štruktúry a následnou kalcináciou v teplotnom intervale od 900 do 1300°C. SN granule boli charakterizované s pohľadu ich chemického a fázového zloženia a vybraných biologických vlastností.

2. Príprava SN mikroguličiek plameňovou syntézou s rôznou štruktúrou, pórovitosťou a podielom bioaktívnej zložky. Pri tejto technológii bol stanovený vplyv jednotlivých parametrov (granulácia východiskovej zmesi a jej chemické zloženie, rýchlosť dávkovania, teplota plameňa a zdržný čas) na výsledné vlastnosti mikroguličiek po plameňovej syntéze (chemické a fázové zloženie, distribúcia veľkostí častíc, pórovitosť častíc). V tomto prípade sa zatiaľ nepodarilo charakterizovať mikroguličky z pohľadu ich fyzikálno-chemických vlastností (rýchlosť hydrolýzy, transformácia zložiek v roztokoch, biologické in vitro testy).

Nad rámec stanovených cieľov boli získané cenné výsledky v oblasti povrchovej modifikácie hutných kompozitných systémov na báze Si<sub>3</sub>N<sub>4</sub>-Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> kyslík-acetylénovým horákom.

HIČÁK, Michal - HNATKO, Miroslav - SEDLÁČEK, Jaroslav - ŠAJGALÍK, Pavol. Povrchová modifikácia kompozitu Si<sub>3</sub>N<sub>4</sub>-Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> - optimalizácia podmienok opracovania kyslík-acetylénovým horákom = Surface modification of Si<sub>3</sub>N<sub>4</sub>-Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> composites - optimisation of oxyacetylene torch conditions. In Interakcie tavenín s progresívnymi anorganickými materiálmi. 9. odborný seminár. 15. - 16. október 2018, Borinka. Ed. František Šimko, recenzent Pavel Fellner. Bratislava Ústav anorganickej chémie SAV, 2018, p. 105-113. ISBN 978-80-971648-6-7.(Interakcie tavenín s progresívnymi anorganickými materiálmi).

HIČÁK, Michal - HNATKO, Miroslav - LABUDOVÁ, Martina - GALUSKOVÁ, Dagmar - SEDLÁČEK, Jaroslav - ŠAJGALÍK, Pavol. Surface modification of Si<sub>3</sub>N<sub>4</sub> by oxyacetylene torch - influence of grain boundary composition = Povrchová modifikácia Si<sub>3</sub>N<sub>4</sub> kyslík-acetylénovým plameňom - vplyv zloženia na hranici zŕn. In Processing and properties of advanced ceramics and glasses, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : conference proceedings. Eds. Erika Múdra, Alexandra Kovalčíková. - Košice, Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 64-71. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials).

BYSTRICKÝ, Roman - HNATKO, Miroslav - SEDLÁČEK, Jaroslav. Preparation of ferrosilicides by utilization of waste material of industry = Príprava ferrosilicidov spracovaním druhotných surovín z priemyslu. In Processing and properties of advanced ceramics and glasses, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : conference proceedings. Eds. Erika Múdra, Alexandra Kovalčíková. - Košice, Slovak Republic: Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 114-118. ISBN 978-80-89782-10-9. (Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-

SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials).

## 6.) Korózia a zvetrávanie úžitkových skiel (*Corrosion and weathering of tableware glass*)

**Zodpovedný riešiteľ:** Mária Chromčíková  
**Trvanie projektu:** 1.1.2018 / 31.12.2021  
**Evidenčné číslo projektu:** 1/0064/18  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** SAV: 2840 €

### Dosiahnuté výsledky:

ČERNÁ, Andrea - HRUŠKA, Branislav - TOKARČÍKOVÁ, Darina - CHROMČÍKOVÁ, Mária - LIŠKA, Marek. Optical microscopy, Raman spectroscopy, and AFM study of heavy weathered surface of barium crystal glass. In Chemical Papers, 2018, vol. 72, no. 9, p. 2153-2158. (0.963 - IF2017). ISSN 0366-6352.

HRUŠKA, Branislav - CHROMČÍKOVÁ, Mária - VARGOVÁ, Veronika - ČERNÁ, Andrea - VOKELOVÁ, Jana - LIŠKA, Marek. Raman spectroscopic study of heavy weathered surface of barium crystal glass. In ICG Annual Meeting 2018. Innovations in Glass and Glass Technologies: Contributions to a Sustainable Society. Japan, 2018, 1 p. - 2P055. (ICG Annual Meeting 2018).

## 7.) Štruktúra a vlastnosti oxidových skiel - termodynamický model, entalpická a objemová relaxácia (*Structure and properties of oxide glasses - thermodynamic models, enthalpic and structural relaxation*)

**Zodpovedný riešiteľ:** Mária Chromčíková  
**Trvanie projektu:** 1.1.2016 / 31.12.2020  
**Evidenčné číslo projektu:** 2/0088/16  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 1 - Slovensko: 1  
**Čerpané financie:** SAV: 1721 €

### Dosiahnuté výsledky:

HRUŠKA, Branislav - OSIPOV, Armenak A. - OSIPOVA, Leyla M. - CHROMČÍKOVÁ, Mária - ČERNÁ, Andrea - LIŠKA, Marek. Thermodynamic model and high-temperature Raman spectra of  $25\text{Na}_2\text{O} \cdot 75\text{B}_2\text{O}_3$  glassforming melts. In Journal of Thermal Analysis and Calorimetry, 2018, vol. 133, no. 1, p. 429-433. (2.209 - IF2017). ISSN 1388-6150.

CHROMČÍKOVÁ, Mária - GAŠPÁREKOVÁ, Eleonóra - ČERNÁ, Andrea - HRUŠKA, Branislav - LIŠKA, Marek. Structural relaxation of lead and barium-free crystal glasses. In Journal of Thermal Analysis and Calorimetry, 2018, vol. 133, no. 1, p. 371-377. (2.209 - IF2017). ISSN 1388-6150

## 8.) Fotoluminiscenčné transparentné keramické materiály na báze oxinitridov (*Photoluminescent transparent oxynitride-based ceramics*)

**Zodpovedný riešiteľ:** Zoltán Lenčes  
**Trvanie projektu:** 1.1.2018 / 31.12.2021  
**Evidenčné číslo projektu:** 2/0164/18  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** SAV: 12480 €

### Dosiahnuté výsledky:

Bolo pripravených sedem rôznych zložení tuhých roztokov  $\text{MgAlON}$  zo zmesi práškov oxidov  $\text{MgO}$ ,  $\text{Al}_2\text{O}_3$  a nitridu  $\text{AlN}$  ich spekaním pri  $1800^\circ\text{C}$  po dobu 3 h v statickej atmosfére dusíka. Analýzou pripravených práškov bolo

potvrdené, že veľkosť častíc MgAlON práškov klesá so zvyšujúcim sa podielom AlN vo východiskovej zmesi. Bolo tiež dokázané, že častice rastú spôsobom vrstva-po-vrstve.

Hutné MgAlON vzorky s relatívnou hustotou 95-98 % teoretickej hustoty boli pripravené reakčným beztlakovým spekaním (PLS). Žiarovým izostatickým lisovaním (HIP) pri 1800 °C po dobu 5 h a tlaku argónu 200 MPa sa podarilo pripraviť niekoľko translucenčných MgAlON vzoriek.

Beztlakovým spekaním vzoriek z komerčného MgAl<sub>2</sub>O<sub>4</sub> východiskového prášku pri 1550 °C po dobu 2 h a následným HIP-ovaním pri 1550 °C po dobu 5 h a tlaku argónu 200 MPa sa podarilo dosiahnuť 99,9 % teoretickej hustoty vzoriek. Priemerná real in-line transmittancia (RIT) vyleštených vzoriek spinelu dosahovala hodnotu 95% teoretického limitu pri vlnových dĺžkach 425 – 705 nm.

Podarilo sa pripraviť translucenčné luminofory na báze spinelu MgAl<sub>2</sub>O<sub>4</sub> s malým prídavkom dopantov, ako chrómu (Cr<sup>3+</sup>), céru (Ce<sup>3+</sup>), samária (Sm<sup>3+</sup>), európie (Eu<sup>3+</sup>), erbia (Er<sup>3+</sup>) a yterbia (Yb<sup>3+</sup>). Meraním absorbancie sme zistili, že tieto látky neabsorbujú modré svetlo. Z toho dôvodu boli luminofory MgAl<sub>2</sub>O<sub>4</sub>:Eu<sup>3+</sup>, MgAl<sub>2</sub>O<sub>4</sub>:Ce<sup>3+</sup>, MgAl<sub>2</sub>O<sub>4</sub>:Yb<sup>3+</sup> a MgAl<sub>2</sub>O<sub>4</sub>:Er<sup>3+</sup> excitované ultrafialovým (UV) žiarením ( $\lambda_{exc}$  = 350-390 nm) a emitovali modré ( $\lambda_{em}$  = 460 nm), žlté ( $\lambda_{em}$  = 570 nm), modré a červené ( $\lambda_{em}$  = 465, 665 nm), fialové a červené (maximá pri  $\lambda_{em}$  = 427, 637, 684, 745 nm) svetlo. Luminofory MgAl<sub>2</sub>O<sub>4</sub>:Cr<sup>3+</sup> a MgAl<sub>2</sub>O<sub>4</sub>:Sm<sup>3+</sup> boli excitované zeleným svetlom ( $\lambda_{exc}$  = 520-530 nm) a emitovali tmavočervené ( $\lambda_{em}$  = 715 nm) a žlté-červené svetlo (maximá pri  $\lambda_{em}$  = 570, 670, 720, 770 nm). Výsledky ukázali, že vyvinuté luminofory neabsorbujú modré svetlo a možno ich excitovať UV alebo zeleným svetlom. Doterajšie výsledky a zvládnutie uvedených problémov dávajú nádej na prípravu nových druhov luminoforov vhodných na konštrukciu vysokovýkonných LED.

Pri štúdiu luminoforov na báze O'-sialonu (všeobecný vzorec Si<sub>2-x</sub>Al<sub>x</sub>O<sub>1+x</sub>N<sub>2-x</sub>) sa podarilo zo zmesi Si<sub>3</sub>N<sub>4</sub> a polymérneho prekursoru SiAlOC pripraviť luminofor O'-sialon:Eu<sup>3+</sup> žiarovým lisovaním pri 1720 °C po dobu 15 min, mechanickom tlaku 30 MPa a následným žiahaním pri 1640 °C po dobu 3 h v atmosfére dusíka. Po excitácii luminoforu UV žiarením bola pozorovaná emisia v zeleno-žltej oblasti svetla s maximom pri 562 nm.

Bola študovaná aj chemická stabilita (hydrotermálna korózia) O'-sialonu v podmienkach subkritickej vody. Vzorky vykazovali výbornú odolnosť voči hydrotermálnej korózii.

#### Publikácie:

1. M. Vetrecin, Z. Lenčoš, D. Galusková, P. Šajgalík: Hydrothermal corrosion resistance of silicon nitride with O'-SiAlON grain boundary phase. *Ceramics – Silikáty*, 62 [4] (2018) 382-388. (doi: 10.13168/cs.2018.0034)
2. M. Radwan, Z. Lenčoš, P. Šajgalík: Synthesis, sintering and optical properties of MgAlON and MgAl<sub>2</sub>O<sub>4</sub> spinel ceramics. In *Processing and Properties of Advanced Ceramics and Glasses*, October 29-31, 2018, Stará Lesná – High Tatras, Slovakia, 2018, pp. 87-93. ISBN: 978-80-89782-10-9, EAN: 9788089782109
3. M. Radwan, J. Sedláček, Z. Lenčoš, P. Šajgalík, "Transparent spinel ceramics for white light-emitting diodes applications", *CIMTEC2018 - 8th Forum on New Materials*, June 10-14, 2018, Perugia, Italy, p. 41.
4. M. Radwan, Z. Lenčoš, J. Sedláček and P. Šajgalík, "Transparent spinel ceramics for white LED applications", *Book of abstracts of the 6th International Conference on the Characterization and Control of Interfaces for High Quality Advanced Materials (ICCCI 2018) and the 54th Summer Symposium on Powder Technology*, July 9-12, 2018, Kurashiki, Japan, p. 161.
5. M. Radwan, Z. Lenčoš, A. Czimerová, P. Šajgalík, "Polymer precursor derived silicon oxynitrides and transparent spinel ceramics for LED applications", *Abstracts of the 12th International Conference on Ceramic Materials and Components for Energy and Environmental Applications (CMCEE 2018)*, July 22-27, 2018, Singapore, p. 148.
6. M. Radwan, J. Sedláček, A. Czimerová, Z. Lenčoš and P. Šajgalík, "Transparent spinel ceramic phosphors", *Phosphor Safari 2018 Conference*, November 4-7, 2018, Seoul, Republic of Korea, p. 36.

### 9.) Funkcionalizácia ílových minerálov netradičnými organickými surfaktantmi (*Functionalization of clay minerals using unconventional organic surfactants*)

<b>Zodpovedný riešiteľ:</b>	Jana Madejová
<b>Trvanie projektu:</b>	1.1.2017 / 31.12.2020
<b>Evidenčné číslo projektu:</b>	2/0141/17
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	SAV: 27138 €

#### Dosiahnuté výsledky:

V druhom roku riešenia projektu sa pokračovalo v príprave a charakterizácii organo-montmorillonitov (O-Mt) s rôznymi typmi surfaktantov. V prípade O-Mt pripravených pomocou série n-alkylamóniových (C<sub>n</sub>-NH<sub>3</sub>, n=1 -19) kationov sa pozoroval vplyv dĺžky alkylového reťazca na usporiadanie/konformáciu surfaktantov namä pomocou IČ spektroskopie v blízkej oblasti (NIR). NIR spektrá O-Mt s kationmi tzv. oktylového radu ukázali, že prítomnosť

molekúl vody vo vzorkách spôsobuje nárast množstva usporiadaných “trans” a pokles neusporiadaných “gauche” konformérov [1]. Pripravili a charakterizovali sa O-Mt zo syntetických dioktaedrických (kunipia) a trioktaedrických (sumecton) smektitov a alkylamónnych a alkylfosfóniových surfaktantov. Ab initio molekulová dynamika na DFT úrovni bola použitá na štúdium štruktúry beidelitu (Bd) interkalovaného tetrabutylfosfóniovým kationom (TBP). Analýza vodíkových väzieb v navrhnutých modeloch ukázala, že Ow-H..Ob H-väzby zodpovedné za viazanie hydratovaného sodného kationu na bazálnu rovinu tetraédrickej siete Bd boli trochu slabšie ako Ow-H..Ow vodíkové väzby medzi molekulami vody pre Na-Bd aj pre TBP-Bd. Vypočítané interkalačné energie ukázali, že TBP-Bd je vysoko stabilný [2]. Využitím senzorických vlastností metachromatických farbív sa podrobne charakterizovali procesy adsorpcie organických kationov, vrátane kinetiky a mechanizmy ich medzimolekulových interakcií na povrchu smektitu. Zistené zákonitosti a princípy môžu pomôcť pochopiť mechanizmy adsorpcie a súvisiace procesy aj pri interakcii s inými organickými kationmi [3]. Testovali sa aj biologické účinnosti O-Mt na rast baktérií a cytotoxicita. Ich účinnosť zodpovedá približne úrovni biologickej účinnosti samotných surfaktantov použitých pri syntéze O-Mt pri rovnakej koncentrácii účinnej zložky. Vysokoučinné boli materiály so surfaktantom s dlhým alifatickým reťazcom, pričom malá účinnosť, ale aj nízka cytotoxicita, bola pozorovaná pre surfaktanty s krátkymi alkylovými reťazcami, konkrétne. tetrabutylamónia a tetrabutylfosfónia [4]. Študoval sa aj vplyv podmienok syntézy Mt/PDDA/Ru kompozitu na jeho využitie pri hydrogenácii 2-butanonu za miernych podmienok. Ukázalo sa, že podmienky syntézy majú vplyv na štruktúrne a termické vlastnosti kompozitu a kontrolujú distribúciu a veľkosť Ru častíc. Katalytická účinnosť kompozitu závisí na veľkosti Ru častíc a na množstve interkalovaného PDDA polyméru [5].

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[3] BARANYAIOVÁ, Timea - BUJDÁK, Juraj. Effects of dye surface concentration on the molecular aggregation of xanthene dye in colloidal dispersions of montmorillonite. In *Clays and Clay Minerals*, 2018, vol. 66, no. 2, p. 114-126. (1.825 - IF2017). ISSN 0009-8604

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## 10.) Vývoj pokročilých nástrojov na výpočet a intepretáciu NMR a EPR spektier systémov ťažkých prvkov (*Development of advanced tools for calculation and interpretation of NMR and EPR spectra of heavy element compounds*)

**Zodpovedný riešiteľ:**

Oľga Malkin

**Trvanie projektu:**

1.1.2017 / 31.12.2020

**Evidenčné číslo projektu:**

2/0116/17

**Organizácia je koordinátorom projektu:**

áno

**Koordinátor:**

Ústav anorganickej chémie SAV

**Počet spoluriešiteľských inštitúcií:**

0

**Čerpané financie:**

SAV: 12923 €

### Dosiahnuté výsledky:

DRAČÍNSKÝ, Martin - BUCHTA, Michal - BUDĚŠÍNSKÝ, Miloš - VACEK-CHOCHOLOUŠOVÁ, Jana - STARÁ, Irena G. - STARÝ, Ivo - MALKINA, Oľga. Dihydrogen contacts observed by through-space indirect NMR coupling. In *Chemical Science*, 2018, vol. 9, no. 38, p. 7437-7446. (9.063 - IF2017). ISSN 2041-6520.

GALL, Marián - BUČINSKÝ, Lukáš - KOMOROVSKÝ, Stanislav. General build up of K+ basis and K2+ matrix in the diagonalization approach. Determination of Kramers configuration state functions. In *International Journal of Quantum Chemistry*, 2018, vol. 118, no. 16, e25638-1-e25638-16. (2.568 - IF2017). ISSN 0020-7608.

Pi A. B. Haase, Michal Repisky, Stanislav Komorovsky, Jesper Bendix, and Stephan P. A. Sauer, *Chem. Eur. J.* 2018, 24, 5124 – 5133

### 11.) Fluoridové taveninové systémy s potenciálom využitia v elektrochemickej výrobe hliníka (*Fluoride melts with potential applications in electrochemical aluminum production*)

**Zodpovedný riešiteľ:** František Šimko  
**Trvanie projektu:** 1.1.2018 / 31.12.2021  
**Evidenčné číslo projektu:** 2/0060/18  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** SAV: 11146 €

#### Dosiahnuté výsledky:

Uskutočnila sa komplexná štruktúrna a fázová analýza systému  $\text{RbF-Al}_2\text{O}_3$ . Zadefinovali sa fázové polia vo fázovom diagrame a identifikovali sa primárne tuhé fázy, existujúce v skúmanom systéme. Určilo sa, že systém reprezentuje stabilnú diagonálu kvartérneho systému  $\text{RbF-Al}_2\text{O}_3\text{-AlF}_3\text{-Rb}_2\text{O}$ . Analýzy fázových polí ukázali prítomnosť veľkého množstva komplexných zložiek v systéme, a to  $\text{Rb}_3\text{AlF}_6$ ,  $\text{RbAlF}_4$ ,  $\text{RbAlO}_2$ ,  $\text{RbAl}_9\text{O}_{14}$ ,  $\text{RbAl}_{11}\text{O}_{17}$  a  $\text{Rb}_2\text{Al}_2\text{O}_3\text{F}_2$ . Všetky uvedené zlúčeniny boli tiež pripravené v čistom stave. Uskutočnila sa ich štruktúrna charakterizácia v tuhom stave s použitím najnovších NMR techník, vrátane MQ-MAS a D-HMQC, ktoré poskytli nový a jasnejší pohľad na ich vzájomnú štruktúrnú koreláciu. Išlo o štruktúrnú podobnosť kovalentne viazaných  $\text{FO}_2\text{Al-O-AlO}_2\text{F}$  tetraédrov v štruktúre  $\text{Rb}_2\text{Al}_2\text{O}_3\text{F}_2$  s usporiadaním  $\text{O}_3\text{Al-O-AlO}_3$  tetraédrov v štruktúre oxohlinitanu "mullitového" typu,  $\text{RbAl}_{11}\text{O}_{17}$ . Z analýzy jednotlivých fázových polí vyplýva aj vzájomné metastabilné správanie objavených zložiek v systéme.

#### **Programy: APVV**

### 12.) Fluoridové taveniny kritických prvkov pre nekonvenčné aplikácie (*Fluoride melts of critical elements for unconventional applications*)

**Zodpovedný riešiteľ:** Miroslav Boča  
**Trvanie projektu:** 1.7.2016 / 30.6.2020  
**Evidenčné číslo projektu:** APVV-15-0479  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** APVV: 60000 €

#### Dosiahnuté výsledky:

Pre 11 ternárnych fluorozirkónových zlúčenín s rôznym koordinačným číslom centrálného atómu – Zr, ako i s rôznymi spôsobmi viazania atómu fluóru boli uskutočnené  $^{19}\text{F}$  MAS NMR a XPS merania. XPS údaje ukázali, že väzbové energie 1s elektrónov fluóru sú úzko späté s jeho koordinačnými vlastnosťami (iónové, terminálne alebo mostíkové viazanie). Iónovo viazané fluóry majú najnižšiu väzbovú energiu, nasledujú terminálne viazané atómy fluóru a najvyššiu väzbovú energiu majú mostíkovo viazané atómy fluóru. V prípade atómov zirkónia tomu tak nie je, šesť, sedem či osem koordinácia zirkónia nemá detegovateľný vplyv na hodnotu väzbovej energie jeho orbitálov. Z merania MAS NMR sa zistilo, že chemický posun  $^{19}\text{F}$  koreluje s iónovými polomermi kationov pre  $\text{Li}_2\text{ZrF}_6$ ,  $\text{Rb}_2\text{ZrF}_6$ ,  $\text{Cs}_2\text{ZrF}_6$  and  $\text{K}_3\text{ZrF}_7$ ,  $(\text{NH}_4)_3\text{ZrF}_7$  a  $\text{Na}_3\text{ZrF}_7$ .

#### Publikácie a príspevky:

RAKHMATULLIN, Aydar - BOČA, Miroslav - MLYNÁRIKOVÁ, Jarmila - HADZIMOVÁ, Eva - VASKOVÁ, Zuzana - POLOVOV, Ilya B. - MIČUŠÍK, Matej. Solid state NMR and XPS of ternary fluoro-zirconates of various coordination modes. In Journal of Fluorine Chemistry, 2018, vol. 208, p. 24-35. (1.879 - IF2017). ISSN 0022-1139.  
 BOČA, Miroslav - RAKHMATULLIN, Aydar - MLYNÁRIKOVÁ, Jarmila - VASKOVÁ, Zuzana - NETRIOVÁ, Zuzana - MIČUŠÍK, Matej. XPS and MAS NMR spectroscopy of ternary fluorides. In HTMC XVI. 16th IUPAC high temperature materials chemistry conference, July 2 - 6, 2018, Ekaterinburg, Russia : book of abstracts. - Ekaterinburg, Russia : Ural State Pedagogical University, 2018, p. 173. ISBN 978-5-7186-1042-0. (HTMC XVI. IUPAC Conference on High Temperature Materials Chemistry).

BOČA, Miroslav - RAKHMATULLIN, Aydar - MLYNÁRIKOVÁ, Jarmila - VASKOVÁ, Zuzana - NETRIOVÁ, Zuzana - KUBÍKOVÁ, Blanka - MIČUŠÍK, Matej. XPS a MAS NMR spektroskopie ternárnych fluoridov = XPS and MAS NMR spectroscopy of ternary fluorides. In Interakcie tavenín s progresívnymi anorganickými materiálmi. 9. odborný seminár. 15. - 16. október 2018, Borinka. - Bratislava : Ústav anorganickej chémie SAV, 2018, p. 102-103. ISBN.

### 13.) Prevencia a eradikácia mikrobiálnych biofilmov vo vzťahu k nanomateriálom (*Prevention and eradication of microbial biofilms in relationship to nanomaterials*)

**Zodpovedný riešiteľ:** Juraj Bujdák  
**Trvanie projektu:** 1.7.2016 / 30.6.2020  
**Evidenčné číslo projektu:** APVV-15-0347  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Prírodovedecká fakulta UK  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** APVV: 22000 €

#### Dosiahnuté výsledky:

Dôležitou úlohou bola príprava fotoaktívnych hybridných materiálov a potlačenie nežiadúcej molekulovej agregácie. Rozpracovali sa metódy syntéz materiálov s komplexným zložením zahŕňajúce aj organické polymérne látky. Dokázalo sa, že aj ďalšie zložky popri fotosenzibilizátoroch môžu mať významné antimikrobiálne vlastnosti. Príkladom sú povrchovoaktívne organické kationy, ktoré sa použili primárne na modifikáciu povrchu. Tieto modifikátory majú aj významný vplyv na fotofyzikálne vlastnosti farbív. V ďalších čiastkových úlohách sa charakterizovali vlastnosti fotosenzibilizátorov a úspešne sa vyvinula metóda na prípravu fotoaktívnych povrchov polymérov.

### 14.) Keramické materiály pre použitie v extrémnych podmienkach (*Ceramic materials for extreme operating conditions*)

**Zodpovedný riešiteľ:** Ján Dusza  
**Zodpovedný riešiteľ v organizácii SAV:** Pavol Šajgalík  
**Trvanie projektu:** 1.7.2016 / 30.6.2020  
**Evidenčné číslo projektu:** APV-15-0469  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Ústav materiálového výskumu SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** APVV: 20480 €

#### Dosiahnuté výsledky:

Na základe minuloročných experimentálnych aktivít venovaných smerom k optimalizácii spôsobu výroby keramických kompozitných materiálov na báze TiB<sub>2</sub>-SiC-GNPLs (Graphene NanoPLatelets), boli v tomto roku pripravené 2 série TiB<sub>2</sub>-SiC materiálov s prídavkom rôzneho obsahu 2 druhov grafénových nanoplatničiek (1, 2, 5, a 10 hm.%). Takto pripravené materiály boli ďalej podrobené dôkladnej mikroštruktúrnej a fázovej analýze, ako aj stanoveniu základných mechanických vlastností pri izbovej teplote. Z dôvodov aplikačného potenciálu materiálov na báze TiB<sub>2</sub>, bola hlavná pozornosť venovaná štúdiu tribologických vlastností, t.j. odolnosti proti opotrebeniu, ale rovnako aj tvrdosti a lomovej húževnatosti. Vo všetkých prípadoch boli výsledky porovnávané s referenčnými TiB<sub>2</sub>-SiC materiálmi, bez prídavku grafénových nanoplatničiek. Bol študovaný vplyv rôzneho množstva grafénových nanoplatničiek na vývoj mikroštruktúry a mechanické vlastnosti materiálov. V ďalšom kroku bude pripravených viacej kusov materiálov pre štúdium pevnosti, ako aj vysokoteplotných vlastností.

#### Publikácie:

SAUNDERS, Theo G. - TATARKO, Peter - GRASSO, Salvatore - REECE, Michael J. Effectiveness of boron welding flux in improving the wettability of ZrB<sub>2</sub> in contact with molten Cu. In Journal of the European Ceramic Society, 2018, vol. 38, no. 12, p. 4198-4202. (3.794 - IF2017). ISSN 0955-2219.

### 15.) Kompozitné vrstvy pre vysokoteplotnú protikoróznú ochranu kovov (*Advanced composite coatings for high temperature corrosion protection of metals*)



<b>Zodpovedný riešiteľ:</b>	Dušan Galusek
<b>Trvanie projektu:</b>	1.7.2016 / 30.6.2020
<b>Evidenčné číslo projektu:</b>	APVV-15-0014
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	2 - Slovensko: 2
<b>Čerpané financie:</b>	APVV: 22500 €

### Dosiahnuté výsledky:

Aktivity v roku 2018 boli ďalej zamerané najmä na prípravu vrstiev s pasívnymi a sklenými plnivami modifikáciou optimalizovaných zložení pripravených v roku 2017. Optimalizovali sa tiež podmienky ich prípravy (obsah plnív, organokremičitého polyméru, rozpúšťadla). Rovnako ako v predchádzajúcich etapách, na prípravu PDC povlakov sa použil systém pozostávajúci z dvoch vrstiev, ktorý spočíva z prípravy základného povlaku z prekursora perhydropolysilazánu (PHPS) a keramickej vrchnej vrstvy pripravenej z prekursora HTT1800 a plnív. Ako kovový substrát pre nanášanie povlakov sa opäť zvolila chrómová nerezová feritická oceľ AISI441, ktorá sa bežne používa v prvkoch odvádzajúcich spaliny. Keďže vo väčšine prípadov je najslabším miestom rozhranie medzi základným povlakom a kovovým substrátom, kde často dochádza v dôsledku nezhody koeficientu teplotnej rozťažnosti (CTE) a prítomnosti nečistôt na povrchu, k delaminácii povlaku už počas pyrolýzy. V tejto etape sa preto otestovali rôzne spôsoby čistenia nehrdzavejúcej ocele s cieľom získať adhézne povlaky s dostatočnou ochrannou schopnosťou pri teplotách okolo 1000 °C. Hlavným cieľom tohto experimentu bolo analyzovať vplyv rôznych spôsobov čistenia (čistenie v ultrazvuku, pieskovanie, chemické leptanie a kombinácia týchto metód) na vlastnosti povrchu substrátu a adhéziu základného povlaku, vybrať najvhodnejší spôsob čistenia a predísť tak odlupovaniu vrstiev počas tepelného spracovania. Ultrazvukové čistenie v acetóne, etanole a destilovanej vode je najúčinnnejšie pre dosiahnutie dostatočného spojenia základného povlaku a oceľového substrátu.

U korózných vrstiev s vysokým obsahom skla (YSZ:sklo= 3:5) je evidentné, že po oxidačných testoch pri 950 °C došlo k výraznému zvýšeniu pórovitosti vrstiev a nárastu pórov so súčasným dramatickým poklesom hrúbky povlakov, ktoré tak ďalej nemôžu plniť funkciu účinnej bariéry voči oxidácií. Pozorovaný jav je spôsobený práve vysokou frakciou použitej sklenej frity a následným diferenčným spekaním jednotlivých komponentov viskóznym tokom. Pri zloženiach s rovnomerným pomerom YSZ a skla (1:1) sa zvýšila nielen súdržnosť medzi časticami, ale aj adhézia ku základnému povlaku a substrátu. Mikroštruktúra takýchto vrstiev pozostáva z častíc pasívneho plniva a sklených frit, ktoré sú homogénne distribuované v keramickej fáze vzniknutej konverziou polysilazánu. V prípade týchto zložení neboli pozorované výrazné praskliny, pričom došlo k zvýšeniu hutnosti pripraveného povlaku do tej miery, že sú prítomné iba uzavreté póry. Najlepšie získané výsledky pri príprave povlakov poskytla kombinácia polyméru HTT1800, YSZ, sklenej frity G018-281 a práškového prekursora AYZ. Výsledné PDC povlaky (zloženie D2 a D3) pozostávajú zo stabilnej keramickej matrice, ktorá je s plnivami previazaná. Pridanie práškového prekursora napomohlo k vytvoreniu pevnej a členitej štruktúry, ktorá umožnila unik rozkladných plynov zo systému a tým efektívne zníženie veľkosti a množstva pórov. Aj keď povlaky nie sú plne hutné, ako sa vyžaduje pre EBC povlaky, takáto mikroštruktúra so zvyškovou pórovitosťou je prospešná pre termickú stabilitu povlakov, pretože prispieva k zmierneniu zvyškových pnutí počas cyklov ohrevu a chladenia. Taktiež znížením rozdielov CTE a elastického modulu dochádza k zmierneniu pnutí v povlaku, čo vedie k vyššej stabilite povlakov počas termického zaťaženia.

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2. Anna Prnová, Alfonz Plško, Jana Valúchová, Katarína Haladejová, Róbert Klement, Dušan Galusek; Crystallization kinetics of glass microspheres with yttrium aluminium garnet (YAG) composition; ISSN 1388-6150, Volume 131, Number 2, J Therm Anal Calorim (2018), 131:1115-1123, DOI 10.1007/s10973-017-6690-9
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**16.) Nové sklenené a sklokeramické fosfory na báze hlinitanov vzácnych zemín pre aplikácie v pevnolátkových energií šetriacich svetelných zdrojoch vyžarujúcich biele svetlo (pc-ELED diódy) (Novel glass and glass-ceramic rare-earth aluminates-based phosphors for energy-savin solid state lighting sources emitting while light (pc-WLEDs))**

**Zodpovedný riešiteľ:** Dušan Galusek  
**Trvanie projektu:** 1.8.2018 / 31.7.2022  
**Evidenčné číslo projektu:** APVV-17-0049  
**Organizácia je koordinátorom projektu:** nie  
**Koordinátor:** Trenčianska univerzita Alexandra Dubčeka v Trenčíne  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** 0

Dosiahnuté výsledky:

V rámci daného schváleného časového horizontu riešenia projektu bola optimalizovaná syntéza prekursorových práškov (v nedopovaných systémoch  $Y_2O_3-Al_2O_3$  a  $Y_2O_3-Al_2O_3-SiO_2$ ) modifikovanou metódou podľa Pechiniho. Následne bol optimalizovaný proces plameňovej syntézy prípravy sklených mikrogulôčok. Pripravené sklá z pohľadu chemického zloženia vykazovali vysokú homogenitu čo bolo potvrdené SEM/EDS a RTG fluorescenčnou analýzou. Preštudované boli termické vlastnosti a kinetika kryštalizácie pripravených skiel. Najlepšie termické vlastnosti, vzhľadom na termickú stabilitu skiel, vykazovali sklá s eutektickým zložením resp. blízkosti eutektického zloženia.

**17.) Zhodnotenie druhotných surovín pre materiály s využitím v extrémnych podmienkach**  
*(Assessment of secondary raw materials for the preparation of materials used in extreme conditions)*

**Zodpovedný riešiteľ:** Miroslav Hnatko  
**Trvanie projektu:** 1.7.2016 / 30.6.2020  
**Evidenčné číslo projektu:** APVV-15-0540  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** APVV: 39804 €

Dosiahnuté výsledky:

Na základe predchádzajúcich detailných analýz zloženia a termodynamických procesov prebiehajúcich v jednotlivých vyselektovaných prúdov druhotných surovín, resp. ich zmesí prebiehali v ostatnom období výskumné úlohy v rôznych oblastiach s uvedenými čiastkovými úlohami:

(i) výskum v oblasti kameniva na báze oxidov, karbidov a nitridov pre použitie v stavebných technológiách – optimalizácia procesu prípravy pórovitého ako aj hutného kameniva zo zmesí druhotných surovín s vysokým obsahom  $SiO_2$ ; optimalizácia in-situ tvorby SiC spevňujúcej fázy za účelom zvýšenia mechanickej pevnosti a húževnatosti pripraveného kameniva. Vhodnou kombináciou druhotných surovín bolo možné pripraviť tzv. ľahké kamenivo s otvorenou pórovitosťou až do 50 obj.% na báze oxidov (majoritné fázy: mulit, kremeň, magnetit, atď.). Optimalizácia procesu karbotermickej redukcie druhotných surovín s uhlíkom (sadze) umožnila prípravu vzoriek kameniva s in-situ vytvorenými časticami SiC pri  $1550^\circ C$  v atmosfére Ar.

(ii) výskum v oblasti využitia druhotných surovín na prípravu ferozliatin – kombináciou druhotných surovín z dvoch zdrojov (technológií) bol optimalizovaný proces prípravy ferozliatin za účelom posúdenia vhodnosti prístupu „recyklácie“ odpadov zložením blízkych bežne používaným surovinám. Karbotermická redukcia s uhlíkom pri podmienkach rýchleho zohrevu ( $100^\circ C/min$ ) umožnila v relatívne krátkom čase (3 min) tvorbu FeSi a SiC (ako vedľajšieho produktu), pričom predĺžením času výdrže na teplote  $1550^\circ C$  dochádzalo k zvyšovaniu podielu pripravených silicidov (FeSi,  $Fe_5Si_3$ ) na úkor vznikajúcej trosky (na báze kremičitanov).

(iii) výskum v oblasti keramicko-cementových kompozitov – kombináciou druhotných surovín bola skúmaná možnosť náhrady ílových a slieňových minerálov pre prípravu kompozitných materiálov s cementom. Prebiehala optimalizácia procesu prípravy kompozitov z pohľadu prípravy zmesí, vplyvu prídavku vody a teplotného spracovania na mechanické a tepelné vlastnosti.

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HIČÁK, Michal - HNATKO, Miroslav - SEDLÁČEK, Jaroslav - ŠAJGALÍK, Pavol. Povrchová modifikácia kompozitu Si<sub>3</sub>N<sub>4</sub>-Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> - optimalizácia podmienok opracovania kyslík-acetylénovým horákom = Surface modification of Si<sub>3</sub>N<sub>4</sub>-Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> composites - optimisation of oxyacetylene torch conditions. In Interakcie tavenín s progresívnymi anorganickými materiálmi. 9. odborný seminár. 15. - 16. október 2018, Borinka. Ed. František Šimko, recenzent Pavel Fellner. Bratislava, Ústav anorganickej chémie SAV, 2018, p. 105-113. ISBN 978-80-971648-6-7 (Interakcie tavenín s progresívnymi anorganickými materiálmi).

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## 18.) Nanokompozitné materiály na báze organo-fosfóniových smektitov a polymérov (*Nanocomposite materials based on organo-phosphonium smectites and polymers*)

<b>Zodpovedný riešiteľ:</b>	Ľuboš Jankovič
<b>Trvanie projektu:</b>	1.7.2016 / 30.6.2020
<b>Evidenčné číslo projektu:</b>	APVV-15-0741
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	1 - Slovensko: 1
<b>Čerpané financie:</b>	APVV: 35000 €

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## 19.) Fotoluminescenčné keramické materiály na báze oxynitridov kremíka (*Silicon oxynitride-based photoluminescent ceramic materials*)

<b>Zodpovedný riešiteľ:</b>	Zoltán Lenčes
<b>Trvanie projektu:</b>	1.7.2015 / 30.6.2019
<b>Evidenčné číslo projektu:</b>	APVV-14-0385
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	2 - Slovensko: 2
<b>Čerpané financie:</b>	APVV: 34293 €

### Dosiahnuté výsledky:

Boli pripravené tuhé roztoky MgAlON zo zmesi práškov oxidov MgO, Al<sub>2</sub>O<sub>3</sub> a nitridu AlN s rôznym obsahom dusíka. Analýzou pripravených práškov bolo potvrdené, že veľkosť častíc MgAlON práškov klesá so zvyšujúcim sa podielom AlN vo východiskovej zmesi. Bolo tiež dokázané, že častice rastú spôsobom vrstva-po-vrstve.

Hutné MgAlON vzorky s relatívnou hustotou 95-98 % teoretickej hustoty boli pripravené reakčným beztlakovým spekaním (PLS). Žiarovým izostatickým lisovaním (HIP) pri teplote 1800 °C a tlaku argónu 200 MPa sa podarilo pripraviť translucenčné MgAlON vzorky.

Beztlakovým spekaním vzoriek z komerčného MgAl<sub>2</sub>O<sub>4</sub> východiskového prášku pri 1550 °C po dobu 2 h a následným HIP-ovaním pri 1550 °C po dobu 5 h a tlaku argónu 200 MPa sa podarilo dosiahnuť 99,9 % teoretickej hustoty vzoriek. Priemerná real in-line transmittancia (RIT) vyleštených vzoriek spinelu dosahovala hodnotu 95% teoretického limitu pri vlnových dĺžkach 425 – 705 nm.

Podarilo sa pripraviť translucenčné luminofoxy na báze spinelu MgAl<sub>2</sub>O<sub>4</sub> s malým prídavkom dopantov, ako chrómu (Cr<sup>3+</sup>), céru (Ce<sup>3+</sup>), samária (Sm<sup>3+</sup>), európie (Eu<sup>3+</sup>), erbia (Er<sup>3+</sup>) a yterbia (Yb<sup>3+</sup>). Meraním absorbancie sme zistili, že tieto látky neabsorbujú modré svetlo. Z toho dôvodu boli luminofoxy MgAl<sub>2</sub>O<sub>4</sub>:Eu<sup>3+</sup>, MgAl<sub>2</sub>O<sub>4</sub>:Ce<sup>3+</sup>, MgAl<sub>2</sub>O<sub>4</sub>:Yb<sup>3+</sup> a MgAl<sub>2</sub>O<sub>4</sub>:Er<sup>3+</sup> excitované ultrafialovým (UV) žiarením (λ<sub>exc</sub> = 350-390 nm) a emitovali modré (λ<sub>em</sub> = 460 nm), žlté (λ<sub>em</sub> = 570 nm), modré a červené (λ<sub>em</sub> = 465, 665 nm), fialové a červené (maximá pri λ<sub>em</sub> = 427, 637, 684, 745 nm) svetlo. Luminofoxy MgAl<sub>2</sub>O<sub>4</sub>:Cr<sup>3+</sup> a MgAl<sub>2</sub>O<sub>4</sub>:Sm<sup>3+</sup> boli excitované zeleným svetlom (λ<sub>exc</sub> = 520-530 nm) a emitovali tmavočervené (λ<sub>em</sub> = 715 nm) a žlté-červené svetlo (maximá pri λ<sub>em</sub> = 570, 670, 720, 770 nm). Výsledky ukázali, že vyvinuté luminofoxy neabsorbujú modré svetlo a možno ich excitovať UV alebo zeleným svetlom. Doterajšie výsledky a zvládnutie uvedených problémov dávajú nádej na prípravu nových druhov luminoforov vhodných na konštrukciu vysokovýkonných LED.

Bola vykonaná aj sada experimentov s cieľom pripraviť luminofoxy na báze O'-sialonu (všeobecný vzorec Si<sub>2-x</sub>Al<sub>x</sub>O<sub>1+x</sub>N<sub>2-x</sub>). Zo zmesi Si<sub>3</sub>N<sub>4</sub> a polymérneho prekurzoru SiAlOC sa podarilo pripraviť luminofoxy O'-sialon:Eu<sup>3+</sup> žiarovým lisovaním pri 1720 °C po dobu 15 min, mechanickým tlakom 30 MPa a následným žiahaním pri 1640 °C po dobu 3 h v atmosfére dusíka. Po excitácii luminofoxy UV žiarením bola pozorovaná emisia v zeleno-žltej oblasti svetla s maximom pri 562 nm.

Bola študovaná aj chemická stabilita (hydrotermálna korózia) O'-sialonu v podmienkach subkritickej vody. Vzorky vykazovali výbornú odolnosť voči hydrotermálnej korózii.

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M. Radwan, J. Sedláček, Z. Lenčoš, P. Šajgalík, "Transparent spinel ceramics for white light-emitting diodes applications", CIMTEC2018 - 8<sup>th</sup> Forum on New Materials, June 10-14, 2018, Perugia, Italy, p. 41.

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M. Radwan, Z. Lenčoš, A. Czimerová, P. Šajgalík, "Polymer.precursor derived silicon oxynitrides and transparent spinel ceramics for LED applications", Abstracts of the 12<sup>th</sup> International Conference on Ceramic Materials and Components for Energy and Environmental Applications (CMCEE 2018), July 22-27, 2018, Singapore, p. 148.

M. Radwan, J. Sedláček, A. Czimerová, Z. Lenčoš and P. Šajgalík, "Transparent spinel ceramic phosphors", Phosphor Safari 2018 Conference, November 4-7, 2018, Seoul, Republic of Korea, p. 36.

## 20.) Vývoj nových teoretických nástrojov pre predikciu a interpretáciu EPR a NMR parametrov (Developing new theoretical tools for prediction and interpretation of EPR and NMR parameters)

<b>Zodpovedný riešiteľ:</b>	Vladimír Malkin
<b>Trvanie projektu:</b>	1.7.2016 / 30.6.2020
<b>Evidenčné číslo projektu:</b>	APVV-15-0726
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	1 - Slovensko: 1
<b>Čerpané financie:</b>	APVV: 40200 €

### Dosiahnuté výsledky:

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2. JEREMIAS, Lukáš - NOVOTNÝ, Jan - REPISKÝ, Michal - KOMOROVSKÝ, Stanislav - MAREK, Radek. Interplay of through-bond hyperfine and substituent effects on the NMR chemical shifts in Ru(III) complexes. In Inorganic Chemistry, 2018, vol. 57, no. 15, p. 8748-8759. (4.700 - IF2017). ISSN 0020-1669.
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## 21.) Vlastnosti nových progresívnych konštrukčných materiálov v agresívnom prostredí roztavených solí (The behaviour of new progressive construction materials in aggressive environment of molten salts)

<b>Zodpovedný riešiteľ:</b>	František Šimko
<b>Trvanie projektu:</b>	1.7.2016 / 30.6.2020
<b>Evidenčné číslo projektu:</b>	APVV-15-0738
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	1 - Slovensko: 1
<b>Čerpané financie:</b>	APVV: 35000 €

### Dosiahnuté výsledky:

Rôzne zmesi roztavených fluoridových solí systémov MeF (Me = Li, Na, K) a AlF<sub>3</sub> sú v súčasnosti predmetom výskumu z dôvodu ich využitia v novej oblasti elektrolyznej výroby hliníka pri nízkej teplote (v porovnaní s teplotou súčasného elektrolyznej procesu) a za použitia inertných elektród. Je známe, že základný faktor procesu výroby, rozpustnosť oxidu hlinitého v taveninách Me<sub>3</sub>AlF<sub>6</sub> (tzv. taveninách na báze kryolitu), sa zvyšuje s veľkosťou Me<sup>+</sup>. Zatiaľ čo je známe, že toto správanie súvisí s rozdielmi v iónovej štruktúre kryolitových tavenín, presná úloha jednotlivých častíc (t.j. Me<sup>+</sup>, AlF<sub>4</sub><sup>-</sup>, AlF<sub>5</sub><sup>2-</sup>, AlF<sub>6</sub><sup>3-</sup> a F<sup>-</sup>) taveniny pri rozpúšťaní oxidu hlinitého nie je úplne jasná a pochopená. Z tohto dôvodu sa študoval vplyv kationov alkalických kovov (Me<sup>+</sup> = Li<sup>+</sup>, Na<sup>+</sup>, K<sup>+</sup>, Rb<sup>+</sup>) na zloženie a

vibračné vlastnosti uvedených kryolitových tavenín. Realizovalo sa to simuláciami molekulárnej dynamiky ab initio v súbore NpT, pri  $T = 1300$  K. Vo všetkých skúmaných sústavách sa zistilo, že častice  $\text{AlF}_5^{2-}$  sa vytvárajú v najvyššom množstve spomedzi všetkých prítomných, Al obsahujúcich aniónových klastrov, od 58% pri Li-tavenine až do 70% pri Na-tavenine. Koncentrácia  $\text{AlF}_4^-$  klastrov sa zvyšuje s veľkosťou  $\text{Me}^+$  kationtov, zatiaľ čo koncentrácia  $\text{AlF}_6^{3-}$  klastrov má opačný trend až po zanedbateľné množstvo v K- a Rb-tavenine. Množstvo atómov Al, ktoré sa zúčastňujú na tvorbe  $\text{Al}_2\text{F}_m^{6-m}$  dimérov, premostených spoločnými atómami F, je významné len v prípade Li- a Na-taveniny (16% a 10%). Tvorba ešte väčších agregátov je vo všetkých štyroch sledovaných taveninách nepravdepodobná. Celkové množstvo atómov F, ktoré nie sú viazané na atómy Al je približne 20% vo všetkých štyroch skúmaných taveninách, pričom životnosť iónov, vznikajúcich z  $\text{Me}^+$  a  $\text{F}^-$ , je len krátkodobá. Výsledky vibračnej analýzy nám umožnili identifikovať zmeny vo variáciách polôh a tvarov pikov zodpovedajúcich fragmentom aniónov  $\text{AlF}_4^-$ ,  $\text{AlF}_5^{2-}$  a  $\text{AlF}_6^{3-}$  v závislosti od veľkosti jednotlivých kationtov. Naše zistenia predstavujú nový pohľad na vlastnosti kryolitových tavenín, ktoré budú užitočné pri interpretácii experimentálnych údajov.

## 22.) Vývoj žiaruvzdorných pyrochlórnych fáz pre vysokoteplotné aplikácie neoxidovej keramiky (*Development of refractory pyrochlore phases for high temperature applications of non-oxide ceramics*)

<b>Zodpovedný riešiteľ:</b>	Peter Tatarko
<b>Trvanie projektu:</b>	1.8.2018 / 30.6.2022
<b>Evidenčné číslo projektu:</b>	APVV-17-0328
<b>Organizácia je koordinátorom projektu:</b>	áno
<b>Koordinátor:</b>	Ústav anorganickej chémie SAV
<b>Počet spoluriešiteľských inštitúcií:</b>	0
<b>Čerpané financie:</b>	APVV: 20638 €

### Dosiahnuté výsledky:

Prvotná etapa projektu bola zameraná na výber vhodných vstupných surovín na základe teoretických analýz, t.j. podrobných termodynamických a fázových analýz. Tie zahŕňajú vysokočisté keramické prášky na báze  $\text{HfB}_2$ ,  $\text{ZrB}_2$ ,  $\text{SiC}$ ,  $\text{ZrSi}_2$ ,  $\text{HfSi}_2$ ,  $\text{B}_4\text{C}$ , uhlíkových sadzí (C) a rôznych oxidických prísad prvkov vzácnych zemín ( $\text{La}_2\text{O}_3$ ,  $\text{Nd}_2\text{O}_3$ ,  $\text{Eu}_2\text{O}_3$ ,  $\text{Yb}_2\text{O}_3$ ,  $\text{Lu}_2\text{O}_3$ ). Vstupné prášky boli navzájom homogenizované rôznymi spôsobmi, pričom množstvo  $\text{ZrSi}_2$ , resp.  $\text{HfSi}_2$ ,  $\text{B}_4\text{C}$  a C bolo vypočítané tak, aby po reakčnom spekaní bol vo finálnom kompozite podiel fáz  $\text{ZrB}_2$ , resp.  $\text{HfB}_2$  a  $\text{SiC}$  v pomere 75:25obj.%. K tejto zmesi boli taktiež pridané rôzne množstvá oxidov prvkov vzácnych zemín. Následne boli experimentálne práce sústredené na nájdenie najvhodnejšej metódy prípravy homogénnej práškovej zmesi, pričom najvhodnejšie sa javia: homogenizácia práškov vo vodnom roztoku s následným vymrazovaním tekutým dusíkom, a homogenizácia práškov v izopropanole s následným odparením pomocou vákuovej rotačnej odparky. V nasledujúcich krokoch bude štúdium orientované smerom k optimalizácii spekania takto pripravených zmesí a následnej podrobnej charakterizácii hutných keramických materiálov.

### Publikácie:

1. FÜRDÖSOVÁ, Zuzana - DLOUHÝ, Ivo - TATARKO, Peter. Preparation and characterization of  $\text{ZrB}_2$ - $\text{SiC}$  based ultra high temperature ceramics = Příprava a charakterizácia vysokoteplotnej keramiky na báze  $\text{ZrB}_2$ - $\text{SiC}$ . In Processing and properties of advanced ceramics and glasses, Stará Lesná - High Tatras, Slovakia, October 29 - 31, 2018 : conference proceedings. Eds. Erika Múdra, Alexandra Kovalčíková. - Košice, Slovak Republic : Institute of Materials Research, Slovak Academy of Sciences, 2018, p. 98-103. ISBN 978-80-89782-10-9.(Processing and Properties of Advanced Ceramics and Glasses. Joint Annual Meeting of the Slovak Silicate Scientific-Technological Society & KIMS Korea-SAS Slovakia Workshop on Advanced Ceramics & FunGLASS conference on Functional Materials).
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## Programy: SASPRO

## 23.) Vlastnosti materiálov po vysokoteplotných koróziách v roztopených soliach (*High-temperature*

*properties of materials corrosion in molten salts)*

**Zodpovedný riešiteľ:** Miroslav Boča  
**Trvanie projektu:** 5.11.2015 / 4.11.2018  
**Evidenčné číslo projektu:** 1119/02/02  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** SAV: 37878 €

Dosiahnuté výsledky:

V roku 2018 sa na projekte pracovalo s dusičnanovými zmesami, a to konkrétne so soľnou zmesou s trhovým názvom "solar salt" (NaNO<sub>3</sub>: KNO<sub>3</sub>, 60: 40 hm.%). Boli vybrané dva materiály (SS304 a SS316L), ktoré boli vystavené pôsobeniu roztavenej soľnej zmesi pri dvoch rôznych teplotách (500 a 550 °C). Nasledovne sa pokračovalo s prídavkami NaCl (2 hm.% a 5 hm.%). Vo všetkých prípadoch sa merali korózne úbytky a po experimente sa prierez vzoriek pozoroval pod elektrónovým mikroskopom. U oboch ocelí sa zistil úbytok chrómu z povrchových vrstiev a tvorba oxidických produktov so železom a chrómom. Z korózných experimentov (po 165 hodinách) sa zistilo, že úbytky materiálov sa zvyšujú s množstvom pridávaného NaCl. Z pomeru úbytkov medzi materiálmi sa mohlo konštatovať, že pre dané podmienky bol vhodnejší materiál SS304. Na upravených vzorkách ocelí pre elektrochemické účely sa na potenciostate napojeným na vysokoteplotnú celu merali oxidačno-redukčné potenciály a polarizačné krivky. Tie sa následne vyhodnocovali Tafelovou analýzou, pričom sa získali korózne charakteristiky materiálov ako korózna rýchlosť, korózny potenciál a korózna odolnosť. Korózne charakteristiky korelovali s úbytkami hmotností a mohol byť navrhnutý mechanizmus korózie týchto materiálov pri daných podmienkach. Na týchto analýzach spolupracoval aj zahraničný expert, Dr. Anna Kityk vrátane jej štipendijného pobytu podporeného Národného štipendijného programu.

**24.) Zviditeľniť relativistickú kvantovú chémiu: Relativistické paramagnetické NMR** (*Moving relativistic quantum chemistry out of the shadow: Relativistic paramagnetic NMR*)

**Zodpovedný riešiteľ:** Vladimír Malkin  
**Trvanie projektu:** 1.10.2016 / 31.12.2018  
**Evidenčné číslo projektu:** 1536/03/02  
**Organizácia je koordinátorom projektu:** áno  
**Koordinátor:** Ústav anorganickej chémie SAV  
**Počet spoluriešiteľských inštitúcií:** 0  
**Čerpané financie:** SAV: 59559 €

Dosiahnuté výsledky:

- 1) J. Novotny, D. Přichystal, M. Sojka, S. Komorovsky, M. Nečas, and Radek Marek, "Hyperfine Effects in Ligand NMR: Paramagnetic Ru(III) Complexes with 3-Substituted Pyridines", Inorg. Chem. 57, 641 (2018). [Q1, I.F 4.71]
- 2) M. Gall, L. Bučinsky, and S. Komorovsky, "General build up of K+ basis and K+2 matrix in the diagonalization approach. Determination of Kramers configuration state functions", Int. J. Quantum Chem. 118, e25638 (2018). [Q1, I.F 2.568]
- 3) P. A. B. Haase, M. Repisky, S. Komorovsky, J. Bendix, and S. P. A. Sauer, "Relativistic DFT Calculations of Hyperfine Coupling Constants in 5d Hexafluorido Complexes: [ReF<sub>6</sub>]<sup>2-</sup> and [IrF<sub>6</sub>]<sup>2-</sup>" Chem. Eur. J. 24, 5124 (2018). [Q1, I.F 5.16]
- 4) J. Vícha, S. Komorovsky, M. Repisky, R. Marek, and M. Straka, "Relativistic Spin-Orbit Heavy Atom on the Light Atom NMR Chemical Shifts: General Trends Across the Periodic Table Explained" J. Chem. Theory Comput. 14, 3025 (2018). [Q1, I.F 5.399]
- 5) L. Konecny, M. Kadek, S. Komorovsky, K. Ruud, and M. Repisky, "Resolution-of-identity accelerated relativistic two- and four-component electron dynamics approach to chiroptical spectroscopies" J. Chem. Phys. 149, 204104 (2018). [Q1, I.F 2.843]
- 6) L. Jeremias, J. Novotny?, M. Repisky, S. Komorovsky, and R. Marek, "Interplay of Through-Bond Hyperfine and Substituent Effects on the NMR Chemical Shifts in Ru(III) Complexes" Inorg. Chem. 57, 8748 (2018). [Q1, I.F 4.7]

**25.) Transparentné luminescentné oxinitridy** (*Transparent luminescent oxynitrides*)

**Zodpovedný riešiteľ:** Pavol Šajgalík  
**Trvanie projektu:** 1.1.2016 / 31.12.2018  
**Evidenčné číslo projektu:** 1329/03/03

**Organizácia je koordinátorom projektu:** áno

**Koordinátor:** Ústav anorganickej chémie SAV

**Počet spoluriešiteľských inštitúcií:** 0

**Čerpané financie:** SAV: 70091 €

Dosiahnuté výsledky:

Optimalizáciou reologických vlastností a stability suspenzií obsahujúcich spinel ( $\text{MgAl}_2\text{O}_4$ ) a následným vymrazovaním v kvapalnom dusíku a odsublímovaním ľadu sa podarilo pripraviť granule  $\text{MgAl}_2\text{O}_4$  s definovaným priemerom. Granulovaný prášok má lepšiu zabiehavosť do lisovacej formy, čím sa dosiahla vyššia hustota výliskov a následne aj nižšia pórovitosť spekaného materiálu. Boli optimalizované podmienky dvojstupňového spekania keramických vzoriek, konkrétne beztlakové spekanie v rýchlom žiarovom lise (rapid hot-pressing) a následné dospekanie vzoriek v izostatickom žiarovom lise (HIP – hot isostatic press). Po optimalizácii podmienok lisovania a spekania vzoriek dosiahla reálna in-line optická priepustnosť (RIT) transparentných  $\text{MgAl}_2\text{O}_4$  vzoriek 95% teoretického limitu pri vlnových dĺžkach 425 – 705 nm.

Podarilo sa pripraviť translucenčné luminofory na báze spinelu  $\text{MgAl}_2\text{O}_4$  s malým prídavkom dopantov, ako chrómu ( $\text{Cr}^{3+}$ ), céru ( $\text{Ce}^{3+}$ ), samária ( $\text{Sm}^{3+}$ ), európie ( $\text{Eu}^{3+}$ ), erbia ( $\text{Er}^{3+}$ ) a yterbia ( $\text{Yb}^{3+}$ ). Meraním absorbancie sme zistili, že tieto látky neabsorbujú modré svetlo. Z toho dôvodu boli luminofory  $\text{MgAl}_2\text{O}_4:\text{Eu}^{3+}$ ,  $\text{MgAl}_2\text{O}_4:\text{Ce}^{3+}$ ,  $\text{MgAl}_2\text{O}_4:\text{Yb}^{3+}$  a  $\text{MgAl}_2\text{O}_4:\text{Er}^{3+}$  excitované ultrafialovým (UV) žiarením ( $\lambda_{\text{exc}} = 350\text{--}390\text{ nm}$ ) a emitovali modré ( $\lambda_{\text{em}} = 460\text{ nm}$ ), žlté ( $\lambda_{\text{em}} = 570\text{ nm}$ ), modré a červené ( $\lambda_{\text{em}} = 465, 665\text{ nm}$ ), fialové a červené (maximá pri  $\lambda_{\text{em}} = 427, 637, 684, 745\text{ nm}$ ) svetlo. Luminofory  $\text{MgAl}_2\text{O}_4:\text{Cr}^{3+}$  a  $\text{MgAl}_2\text{O}_4:\text{Sm}^{3+}$  boli excitované zeleným svetlom ( $\lambda_{\text{exc}} = 520\text{--}530\text{ nm}$ ) a emitovali tmavočervené ( $\lambda_{\text{em}} = 715\text{ nm}$ ) a žltó-červené svetlo (maximá pri  $\lambda_{\text{em}} = 570, 670, 720, 770\text{ nm}$ ). Výsledky ukázali, že vyvinuté luminofori neabsorbujú modré svetlo a možno ich excitovať UV alebo zeleným svetlom. Doterajšie výsledky a zvládnutie uvedených problémov dávajú nádej na prípravu nových druhov luminoforov vhodných na konštrukciu vysokovýkonných LED.

Bola vykonaná aj sada experimentov s cieľom pripraviť luminofor na báze O'-sialonu (všeobecný vzorec  $\text{Si}_{2-x}\text{Al}_x\text{O}_{1+x}\text{N}_{2-x}$ ). Zo zmesi  $\text{Si}_3\text{N}_4$  a polymérneho prekurzoru SiAlOC sa podarilo pripraviť luminofor O'-sialon: $\text{Eu}^{3+}$  žiarovým lisovaním pri  $1720\text{ }^\circ\text{C}$  po dobu 15 min, mechanickom tlaku 30 MPa a následným žiahaním pri  $1640\text{ }^\circ\text{C}$  po dobu 3 h v atmosfére dusíka. Po excitácii luminoforu UV žiarením bola pozorovaná emisia v zeleno-žltej oblasti svetla s maximom pri 562 nm.

Bola študovaná aj chemická stabilita (hydrotermálna korózia) O'-sialonu v podmienkach subkritickej vody. Vzorky vykazovali výbornú odolnosť voči hydrotermálnej korózii.

Publikácie:

M. Vetrecin, Z. Lenčoš, D. Galusková, P. Šajgalík: Hydrothermal corrosion resistance of silicon nitride with O'-SiAlON grain boundary phase. *Ceramics – Silikáty*, 62 [4] (2018) 382-388. (doi: 10.13168/cs.2018.0034)

M. Radwan, Z. Lenčoš, P. Šajgalík: Synthesis, sintering and optical properties of MgAlON and  $\text{MgAl}_2\text{O}_4$  spinel ceramics. In *Processing and Properties of Advanced Ceramics and Glasses*, October 29-31, 2018, Stará Lesná – High tatras, Slovakia, 2018, pp. 87-93. ISBN: 978-80-89782-10-9, EAN: 9788089782109

M. Radwan, J. Sedláček, Z. Lenčoš, P. Šajgalík, "Transparent spinel ceramics for white light-emitting diodes applications", CIMTEC2018 - 8<sup>th</sup> Forum on New Materials, June 10-14, 2018, Perugia, Italy, p. 41.

M. Radwan, Z. Lenčoš, J. Sedláček and P. Šajgalík, "Transparent spinel ceramics for white LED applications", Book of abstracts of the 6<sup>th</sup> International Conference on the Characterization and Control of Interfaces for High Quality Advanced Materials (ICCCI 2018) and the 54<sup>th</sup> Summer Symposium on Powder Technology, July 9-12, 2018, Kurashiki, Japan, p. 161.

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M. Radwan, J. Sedláček, A. Czimerová, Z. Lenčoš and P. Šajgalík, "Transparent spinel ceramic phosphors", Phosphor Safari 2018 Conference, November 4-7, 2018, Seoul, Republic of Korea, p. 36.



**Príloha C****Príloha C - Publikačná činnosť organizácie (generovaná z ARL)****ADCA Vedecké práce v zahraničných karentovaných časopisoch – impaktovaných**

- ADCA01 ASHER, James Richard. An animated visualization of orbital angular momentum and spin-orbit coupling. In International Journal of Quantum Chemistry, 2018, vol. 118, no. 18, art. no. e25683, p. 1-7. (2.568 - IF2017). (2018 - Current Contents). ISSN 0020-7608.
- ADCA02 AZZI, Andreza de Almeida - UHLÍK, Peter - OSACKÝ, Marek - ZANARDO, Antenor - PÁLKOVÁ, Helena. Changes in technological properties and microstructure of clayey raw materials from the Corumbataí Formation upon drying: Relevance to dry route tilemaking process. In Applied Clay Science, 2018, vol. 157, p. 92-101. (3.641 - IF2017). (2018 - Current Contents). ISSN 0169-1317.
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2. [1.2] PRAVEEN KUMAR, S. - MAHAKAVI, P. - SUBA PRIYA, A. Experimental study on structural behaviour of beam



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#### ADEB Vedecké práce v ostatných zahraničných časopisoch – neimpaktovaných

- ADEB01 GALUSEK, Dušan - LENČEŠ, Zoltán - ŠAJGALÍK, Pavol - RIEDEL, Ralf. Thermal analysis study of polymer-to-ceramic conversion of organosilicon precursors. In Journal of Mining and Metallurgy : Section B: Metallurgy, 2008, vol. 44, no. 1, p. 35-38. ISSN 1450-5339.

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1. [1.1] MARKANDAN, Kalaimani - CHIN, JitKai - TAN, Michelle T. T. Low temperature fabrication and characterization of Si-O-C cured alumina toughened zirconia (ATZ). In MATERIALS TODAY-PROCEEDINGS. ISSN 2214-7853, 2017, vol. 4, no. 2, pp. 3005-3013., Registrované v: WOS
2. [1.1] VASILE, M. - LAMONACA, F. - CARNI, D. L. - NASTRO, A. - CIUPINA, V. - MOLDOVEANU, L. E. OBJECTIVE DETECTION OF COXARTHROSIS BY THERMAL ANALYSIS MEASUREMENT TECHNIQUES. In ROMANIAN REPORTS IN PHYSICS. ISSN 1221-1451, 2017, vol. 69, no. 1, pp., Registrované v: WOS

- ADEB02 MALKIN, Vladimír - MALKINA, Oľga - STEINEBRUNNER, G. - HUBER, H. Solvent effect on the NMR chemical shieldings in water calculated by a combination of molecular dynamics and density functional theory. In Chemistry - A European Journal, 1996, vol. 2, no. 4, p. 452-457. ISSN 0947-6539.

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1. [1.1] DAMRON, Joshua T. - KERSTEN, Kortney M. - PANDEY, Manoj Kumar - NISHIYAMA, Yusuke - MATZGER, Adam - RAMAMOORTHY, Ayyalusamy. Role of Anomalous Water Constraints in the Efficacy of Pharmaceuticals Probed by H-1 Solid-State NMR. In CHEMISTRYSELECT. ISSN 2365-6549, 2017, vol. 2, no. 23, pp. 6797-6800., Registrované v: WOS
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#### \*AEC Vedecké práce v zahraničných recenzovaných vedeckých zborníkoch, monografiách

- AEC01 MICHÁLKOVÁ, Monika - GHILLÁNYOVÁ, Katarína - GALUSEK, Dušan. Standard and two-stage sintering of a submicrometer alumina powder: The influence on the sintering trajectory. In International Conference on Sintering, 16.11. - 20.11.2009 : Ceramics Transactions vol. 209: Advances in Sintering Science and Technology. - La Jolla, 2009, p. 421-427. ISBN 978-0-470-40849-0.

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1. [1.1] SUTHARSINI, U. - THANIHAICHELVAN, M. - TING, C. H. - RAMESH, S. - TAN, C. Y. - CHANDRAN, Hari - SARHAN, Ahmed A. D. - RAMESH, S. - URRIES, I. Effect of two-step sintering on the hydrothermal ageing resistance of tetragonal zirconia polycrystals. In CERAMICS INTERNATIONAL. ISSN 0272-8842, 2017, vol. 43, no. 10, pp. 7594-7599., Registrované v: WOS

#### \*AED Vedecké práce v domácich recenzovaných vedeckých zborníkoch, monografiách

- AED01 KRAXNER, Jozef - KLEMENT, Róbert - CHROMČÍKOVÁ, Mária - LIŠKA, Marek. The effect of CaO and MgO on physical properties of MgO-CaO-B<sub>2</sub>O<sub>3</sub>-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> glasses with composition close to the E-glass fibers. In Glass - The Challenge for the 21st Century : 9th Conference of the European Society of Glass Science and Technology/Annual Meeting of the International Commission on Glass, Trenčín, June 22-26, 2008. Eds. M. Liška, D. Galusek, R. Klement, V. Petrušková. - Zurich : TRANS TECH PUBLICATIONS LTD., 2008, p. 81-84. ISBN 978-0-87849-387-6. ISSN 1022-6680.

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1. [1.1] VEIT, Ulrike - RUESEL, Christian. Density of quaternary glasses in the MgO-CaO-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub>-system modeling vs measurement. In INTERNATIONAL JOURNAL OF APPLIED GLASS SCIENCE. ISSN 2041-1286, 2017, vol. 8, no. 3, pp. 301-312., Registrované v: WOS
2. [1.1] VEIT, Ulrike - RUSSEL, Christian. Elastic properties of quaternary glasses in the MgO-CaO-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> system: modelling versus measurement. In JOURNAL OF MATERIALS SCIENCE. ISSN 0022-2461, 2017, vol. 52, no. 13, pp. 8159-8175., Registrované v: WOS

#### \*AEE Vedecké práce v zahraničných nerecenzovaných vedeckých zborníkoch, monografiách

- AEE01 KAŠIAROVÁ, Monika - DUSZA, Ján - HNATKO, Miroslav - ŠAJGALÍK, Pavol. Microstructure and mechanical properties of Si<sub>3</sub>N<sub>4</sub>-SiC nanocomposites. In Nanocon 2009. Rožnov pod Radhoštěm, 20.-22.10.2009. - [S. n.], 2009.(Nanocon 2009).

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1. [1.1] GARSHIN, A. P. - KULIK, V. I. - NILOV, A. S. Shock-Resistant Materials Based on Commercial Grade Ceramic: Achievements and Prospects for Improving Their Ballistic Efficiency. In REFRACTORIES AND INDUSTRIAL CERAMICS.

*ISSN 1083-4877, 2016, vol. 57, no. 2, pp. 207-219., Registrované v: WOS*

## ***Príloha D***

### ***Príloha D - Údaje o pedagogickej činnosti organizácie***

#### Semestrálne prednášky:

James Richard Asher, PhD

Názov semestr. predmetu: General and Inorganic Chemistry

Počet hodín za semester: 20

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra anorganickej chémie

prof. Ing. Dušan Galusek, DrSc.

Názov semestr. predmetu: Anorganické materiály a technológia ich výroby

Počet hodín za semester: 13

Názov katedry a vysokej školy: Trenčianska univerzita Alexandra Dubčeka v Trenčíne, Centrum pre funkčné a povrchovo funkcionizované sklá

prof. Ing. Dušan Galusek, DrSc.

Názov semestr. predmetu: Anorganické materiály a technológia ich výroby

Počet hodín za semester: 13

Názov katedry a vysokej školy: Trenčianska univerzita Alexandra Dubčeka v Trenčíne, Centrum pre funkčné a povrchovo funkcionizované sklá

doc. Ing. Zoltán Lenčoš, PhD.

Názov semestr. predmetu: Anorganická chémia 2

Počet hodín za semester: 8

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra anorganickej chémie

doc. Ing. Zoltán Lenčoš, PhD.

Názov semestr. predmetu: Keramika, kompozity, plasty

Počet hodín za semester: 3

Názov katedry a vysokej školy: Vysoká škola báňská - TU Ostrava, Česká republika, Fakulta metalurgie a materiálového inžinýrství

doc. Ing. Zoltán Lenčoš, PhD.

Názov semestr. predmetu: Materiálová chémia

Počet hodín za semester: 4

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra anorganickej chémie

Ing. František Šimko, PhD.

Názov semestr. predmetu: Anorganická chémia

Počet hodín za semester: 2

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra anorganickej chémie

#### Semestrálne cvičenia:

Mgr. Silvia Belušáková, PhD.

Názov semestr. predmetu: General and Inorganic Chemistry

Počet hodín za semester: 48

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra anorganickej chémie

Ing. Blanka Kubíková, PhD.

Názov semestr. predmetu: Pokročilé cvičenie z fyzikálnej chémie (1)

Počet hodín za semester: 12

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra fyzikálnej chémie

Mgr. Valéria Kureková, PhD.

Názov semestr. predmetu: Metódy charakterizácie anorganických látok

Počet hodín za semester: 2

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra anorganickej chémie

Ing. Jarmila Mlynáriková, PhD.

Názov semestr. predmetu: Pokročilé cvičenie z fyzikálnej chémie (1)

Počet hodín za semester: 12

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra fyzikálnej chémie

Ing. Zuzana Netriová, PhD.

Názov semestr. predmetu: Pokročilé cvičenie z fyzikálnej chémie (1)

Počet hodín za semester: 12

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra fyzikálnej chémie

Mgr. Patrícia Petrisková

Názov semestr. predmetu: Všeobecná a anorganická chémia

Počet hodín za semester: 45

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra anorganickej chémie

### Semináre:

### Terénne cvičenia:

Ing. Ondrej Hanzel, PhD.

Názov semestr. predmetu: Materiálová chémia (prax študentov na ÚACH)

Počet hodín za semester: 50

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra anorganickej chémie

doc. Ing. Zoltán Lenčoš, PhD.

Názov semestr. predmetu: Materiálová chémia (prax študentov na ÚACH)

Počet hodín za semester: 50

Názov katedry a vysokej školy: Prírodovedecká fakulta UK, Katedra anorganickej chémie

### Individuálne prednášky:



**Príloha E****Príloha E - Medzinárodná mobilita organizácie****(A) Vyslanie vedeckých pracovníkov do zahraničia na základe dohôd:**

Krajina	D r u h d o h o d y					
	MAD, KD, VTS		Medziústavná		Ostatné	
	Meno pracovníka	Počet dní	Meno pracovníka	Počet dní	Meno pracovníka	Počet dní
Belgicko	Mária Chromčíková	16				
Česko	Zuzana Fördósová	4				
	Peter Tatarko	4				
Čína	Michal Korenko	14				
Poľsko	Valéria Kureková	12				
	Helena Pálková	12				
<b>Počet vyslaní spolu</b>	<b>6</b>	<b>62</b>				

**(B) Prijatie vedeckých pracovníkov zo zahraničia na základe dohôd:**

Krajina	D r u h d o h o d y					
	MAD, KD, VTS		Medziústavná		Ostatné	
	Meno pracovníka	Počet dní	Meno pracovníka	Počet dní	Meno pracovníka	Počet dní
Česko	Gianmarco Taveri	4				
	Ivo Dlouhý	3				
	Jiří Hybler	7				
	Luca Bertolla	7				
India					Shirshendu Chakraborty	91
Poľsko	Małgorzata Zimowska	19				
Rakúsko					Christina Atzenhofer	31
Rusko					Artem Kuznetsov Borisovich	61
Turecko					Cemile Gizem Toksöz	80
Ukrajina					Anna Kityk	62
<b>Počet prijatí spolu</b>	<b>5</b>	<b>40</b>			<b>5</b>	<b>325</b>

**(C) Účast' pracovníkov pracoviska na konferenciách v zahraničí (nezahrnutých v "A"):**

Krajina	Názov konferencie	Meno pracovníka	Počet dní
Belgicko	Electroceramics	Ondrej Hanzel	6
	ISIEM	Ondrej Hanzel	6
		Anna Prnová	15
	MCAA	Mohamed Radwan	4
Brazília	ICC	Dušan Galusek	9

		Pavol Šajgalík	5
Česko	20. ročník Konference	Anna Prnová	2
	CESTC	Jozef Noga	4
		Štefan Varga	4
	JCS Symposium	Stanislav Komorovský	5
		Oľga Malkin	6
		Vladimír Malkin	6
		Jozef Noga	6
	Kalorimetrický seminár	Mária Chromčíková	8
	SSCh	Mária Chromčíková	5
	Workshop	Zoltán Lenčes	1
	Zjazd chemikov	Anna Prnová	6
Francúzsko	ESG	Mária Chromčíková	4
	PNCS	Mária Chromčíková	4
Chorvátsko	MECC	Martin Barlog	6
		Jana Madejová	6
		Daniel Moreno	6
		Helena Pálková	6
		Michal Slaný	6
		Peter Škorňa	6
		Zoltán Lenčes	4
Japonsko	ICCCI	Mária Chromčíková	6
	ICG	Pavol Šajgalík	6
	ISAC	Juraj Bujdák	5
Maďarsko	11CCC	Dušan Galusek	3
Nemecko	DGG,CSS, SSS	Oľga Malkin	5
Nórsko	TChM	Vladimír Malkin	5
		Hesham Abdelrehim	4
		Ondrej Hanzel	4
		Peter Švančárek	4
Portugalsko	EUCMOS	Eva Scholtzová	15
Rakúsko	MMQC	James Richard Asher	7
		Stanislav Komorovský	6
		Oľga Malkin	7
		Vladimír Malkin	7
Rusko	HTMC	Miroslav Boča	6
		Mária Chromčíková	7
		Martin Kontrík	6
		Blanka Kubíková	6
		Zuzana Netriová	6
		Niketan Patel	11
		Zoltán Lenčes	7
Singapur	CMCEE	Peter Tatarko	7
		James Richard Asher	7
		Oľga Malkin	8
		Vladimír Malkin	8
Švédsko	Design for HIP	Mohamed Radwan	5
Taliansko	CAT	Ľuboš Jankovič	5
	CIMTEC	Mohamed Radwan	6
	ICAM	Silvia Belušáková	11
		Juraj Bujdák	11
USA	CMS	Jana Madejová	6
		Helena Pálková	6
	ICACC	Pavol Šajgalík	6
		Peter Tatarko	6

	MSR	Michal Korenko	2
<b>Spolu</b>	<b>33</b>	<b>61</b>	<b>373</b>

*Vysvetlivky: MAD - medziakademické dohody, KD - kultúrne dohody, VTS - vedecko-technická spolupráca v rámci vládnych dohôd*

### Skratky použité v tabuľke C:

11CCC - 11th Conference on Colloid Chemistry  
 20. ročník Konferencie - 20. ročník Konferencie o špeciálnych anorganických pigmentoch a práškových materiáloch  
 CAT - Global conference on Catalysis  
 CESTC - 16th Central European Symposium on Theoretical Chemistry  
 CIMTEC - 8th Forum on New Materials  
 CMCEE - 12 th International Conference and ceramic Materials and Components for Energy and Environmental Applications  
 CMS - 55th Annual Meeting of the Clay Minerals Society  
 Design for HIP - Design for Hot Isostatic Pressing Seminar  
 DGG,CSS, SSS - 92nd Annual Meeting of the German Society of Glass Technology. Czech Glass Society and the Slovak Glass Society  
 Electroceramics - Electroceramics XVI  
 ESG - 14th European Symposium on Glass Conference  
 EUCMOS - 34th European Congress on Molecular Spectroscopy  
 FunGlass - FunGlass participation in the 2nd Polish – Slovak – Chinese Seminar on Ceramics  
 HTMC - XVI International IUPAC Conference on High Temperature Materials Chemistry  
 ICACC - 42nd International Conference and Exposition on Advanced Ceramics and Composites  
 ICAM - 3rd International Conference on Applied Mineralogy and Advanced Materials  
 ICC - 7th International Congress on Ceramics  
 ICCCI - 6th International Conference on the Characterization and Control of Interfaces for High Quality Advanced Materials  
 ICG - Innovations in Glass and Glass Technologies  
 ISAC - 6th International Symposium on Advanced Ceramics  
 ISIEM - The International Symposium on Inorganic and Environmental Materials  
 JCS Symposium - 7th (Japan-Czech-Slovak) Symposium  
 Kalorimetrický seminár - 40. Medzinárodný český a slovenský kalorimetrický seminár  
 MAGIC - Workshop on Magnetically Induced Currents in Molecules  
 MCAA - 5th Marie Curie Alumni Association General Assambly and Annual Conference  
 MECC - Medzinárodná fiová konferencia  
 MMQC - XIth. Workshop on Modern Methods in Quantum Chemistry  
 MSR - Molten Salts Reactor Workshop  
 PNCS - 15th International Conference on the Physics of Non-Crystalline Solids  
 SSCh - 13th International Conference on Solid State Chemistry  
 TChM - Theoretical Chemistry Meeting  
 Workshop - Workshop: Strategical development of posgradual study programs at FMME  
 Zjazd chemikov - 70. Zjazd chemikov

**Príloha F****Príloha F - Vedecko-popularizačná činnosť pracovníkov organizácie SAV**

Meno	Spoluautori	Typ <sup>1</sup>	Názov	Miesto zverejnenia	Dátum alebo počet za rok
Miroslav Boča		IN	Petržalská super škola sa niesla v znamení periodickej tabuľky prvkov	<a href="https://www.bratislavske-noviny.sk">https://www.bratislavske-noviny.sk</a>	7.12.2018
Miroslav Boča		PB	Prvky známe aj neznáme	Zrkadlový háj, Bratislava	5.12.2018
Miroslav Boča	F. Šimko, B. Kubíková, V. Pavlík	TV	Spektrum vedy – Moderné využitie fluoridových tavenín	RTVS: 2	24.11.2018
Zoltán Lenčes		EX	Exkurzia pre študentov 5. ročníka z Katedry anorganickej chémie PriF UK	ÚACH SAV	5.12.2018
Zoltán Lenčes		EX	Exkurzia pre zamestnancov Korea Institute of Materials Science (KIMS), Changwon, Korea	UACH SAV	28.10.2018
Anna Prnová	R. Klement, J. Valúchová, D. Galusek	PB	Pokročilé inžinierske materiály a ich aplikácie v oblasti komunikácie	Študentská vedecká konferencia na SŠ v Novej Dubnici	23.11.2018
Peter Tatarko		IN	Do SR sa vrátil vedec, ktorý vyvíja materiály pre supersonické lietadlá	tasr.sk	12.2.2018
Peter Tatarko		TV	Hlavné správy - reportáž	RTVS	18.2.2018
Peter Tatarko		IN	Na ceste za vysokoteplotnými materiálmi, vhodnými pre vesmírne aplikácie	vedanadosah.cvtisr.sk	22.3.2018
Peter Tatarko		TV	Ranné správy / reportáž	RTVS	15.2.2018
Peter Tatarko		TV	Relácia VAT	RTVS	31.3.2018
Peter Tatarko		PB	Skúsenosti držiteľa grantu H2020-IF-MSCA	CVTI SR, Bratislava	17.7.2018
Peter Tatarko		IN	Slovák, na ktorého sme hrdí: Peter Tatarko vyvíja materiály pre najmodernejšie lietadlá	Dromedar.sk	12.2.2018
Peter Tatarko		PB	Svet moderných keramických materiálov	DOD 2018 ÚACH SAV	7.11.2018
Peter Tatarko		IN	Tlačová správa: Vývíja materiály pre hypersonické lietadlá	SAV.sk	12.2.2018
Peter Tatarko		IN	Vedec sa po troch rokoch v Londýne vrátil na Slovensko, bude vyvíjať materiál pre nadzvukové lietadlá	Denník N	2.3.2018

<sup>1</sup> PB - prednáška/beseda, TL - tlač, TV - televízia, RO - rozhlas, IN - internet, EX - exkurzia, PU - publikácia, MM - multimédiá, DO - dokumentárny film