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Jožef Stefan International Postgraduate School and Young Researchers' Day CMBO

15 and 16 April 2019, Planica

ORGANIZED BY

Jožef Stefan IPS's Student Council
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Jožef Stefan Institute

Institute of Metals and Technology

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IPSSC + CMBO

Monday, 15.04.2019

WELCOME SPEECH

(IPSSC and the Dean of IPS)

9:30 – 9:40

IPSSC + CMBO

Monday, 15.04.2019

ELEVATOR PITCH

SESSION 1

9:40 – 10:50

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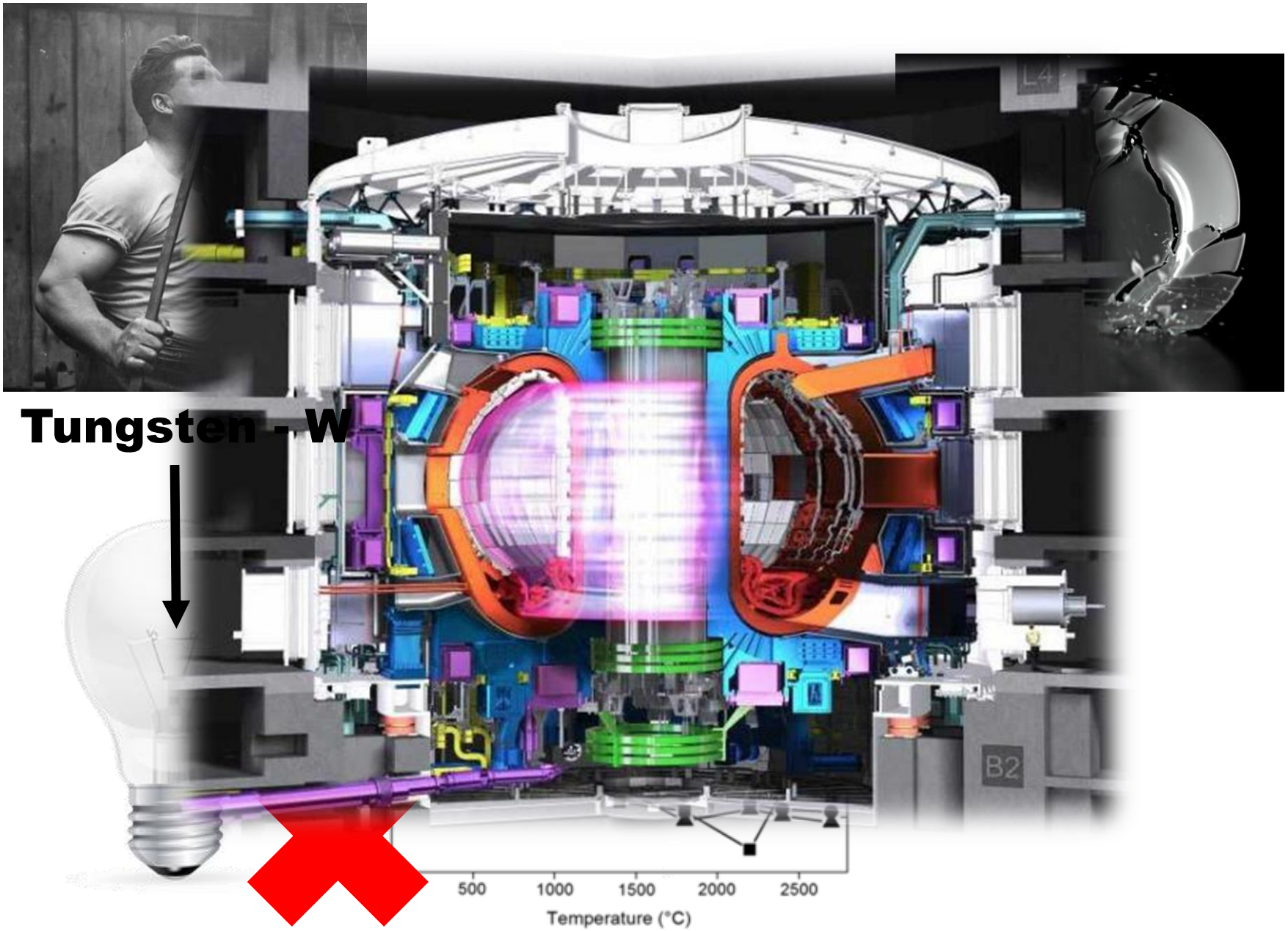
Metals and ceramics, competition or synergy

Matej Kocen,

Petra Jenuš, Anže Abram, Borut Žužek, Jaka Burja, Saša Novak

Poster number: 33


PUT YOUR HANDS TOGETHER


Tungsten - W
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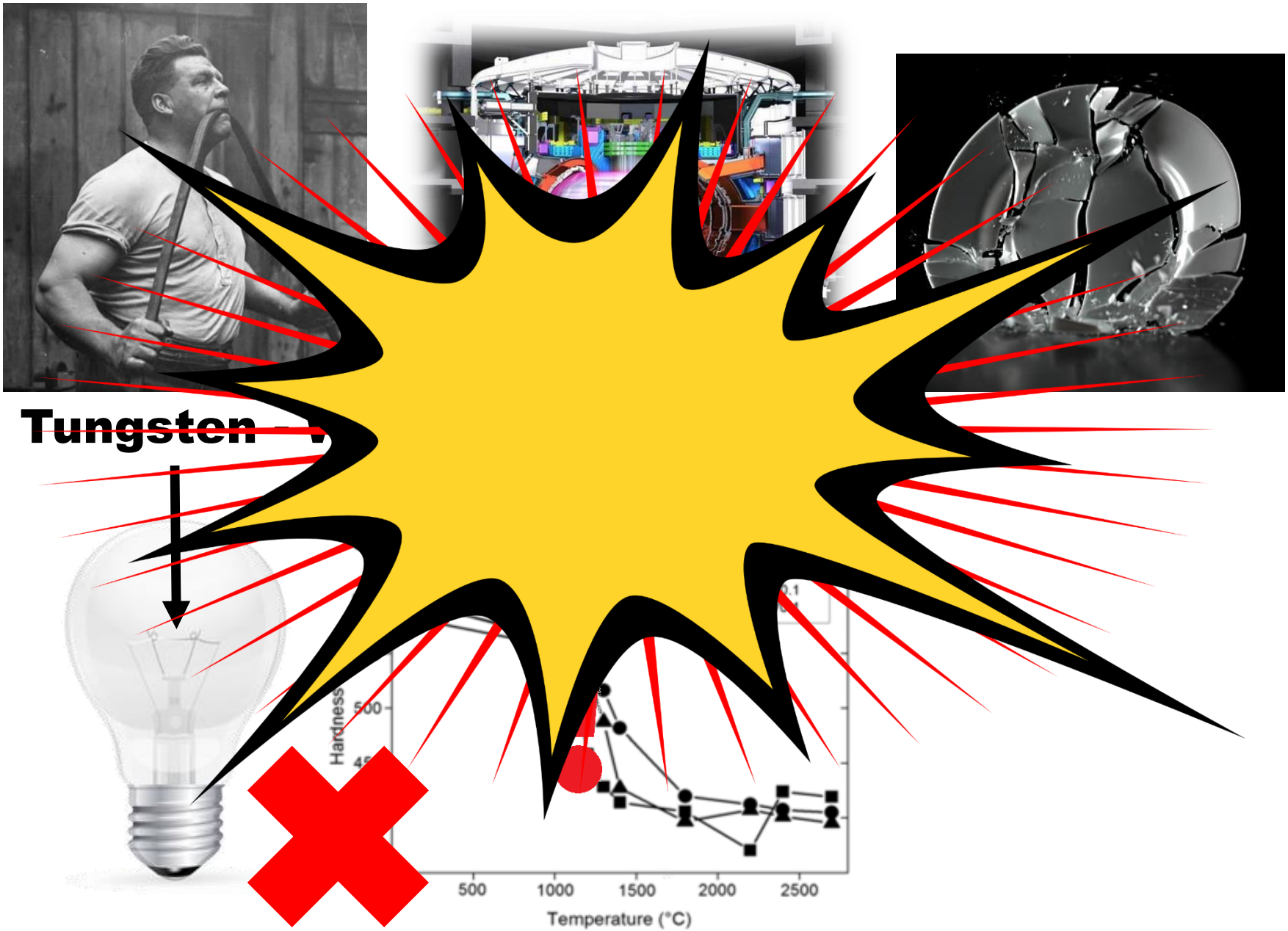
2500
Temperature (°C)
B2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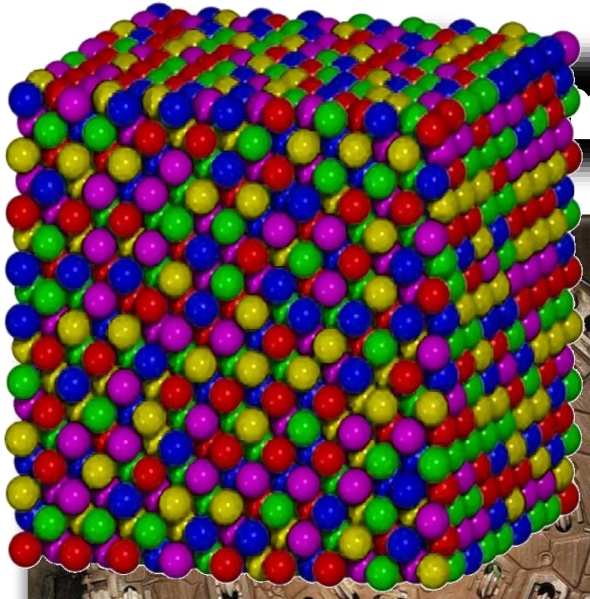

WC – Co/Fe/Ni

IJS samples

WC - HEA

Poster no. 33

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Ammodytoxin: a tool for studying neurodegenerative diseases

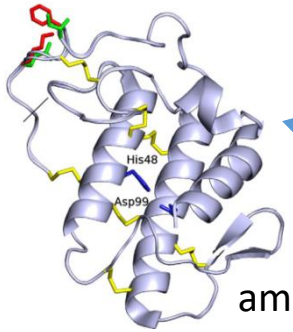
Adrijan Ivanušec

Department of Molecular and Biomedical Sciences, Jožef Stefan Institute

Faculty of Medicine, University of Ljubljana

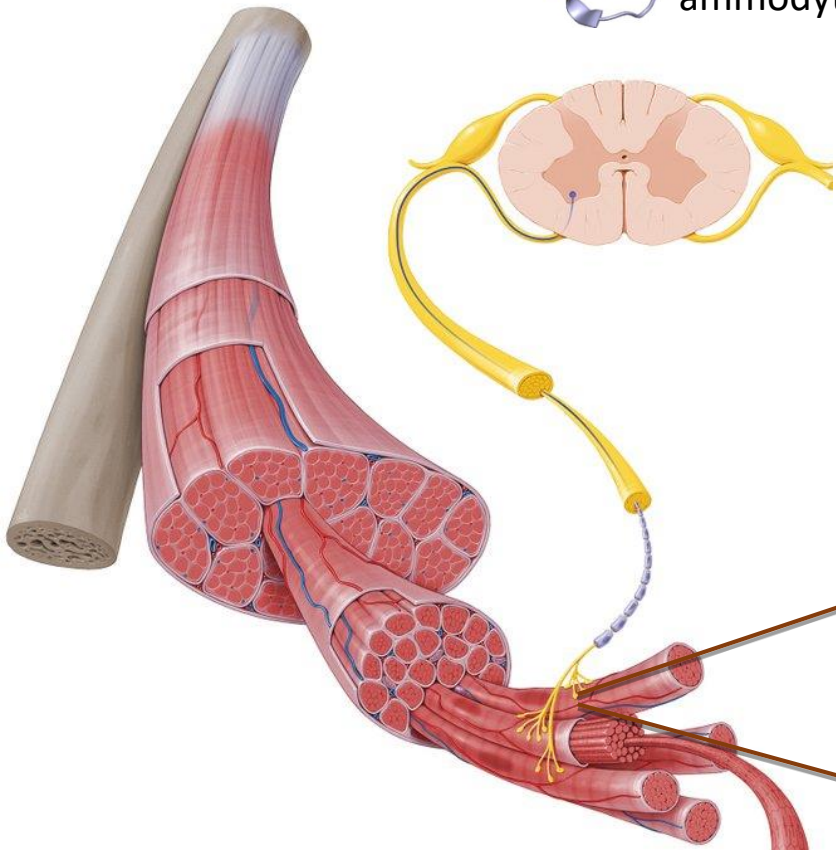
Poster number: 54

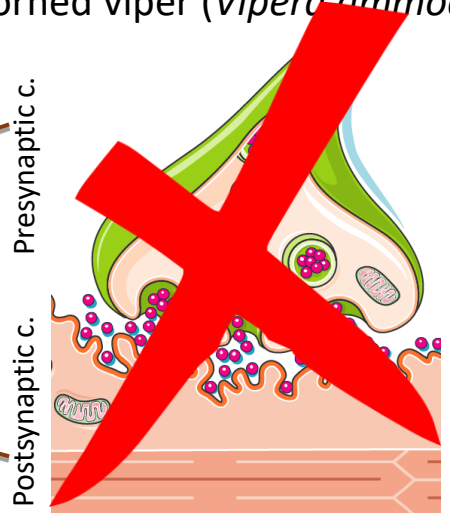
Ammodytoxin: a presynaptic neurotoxin from the nose-horned viper venom



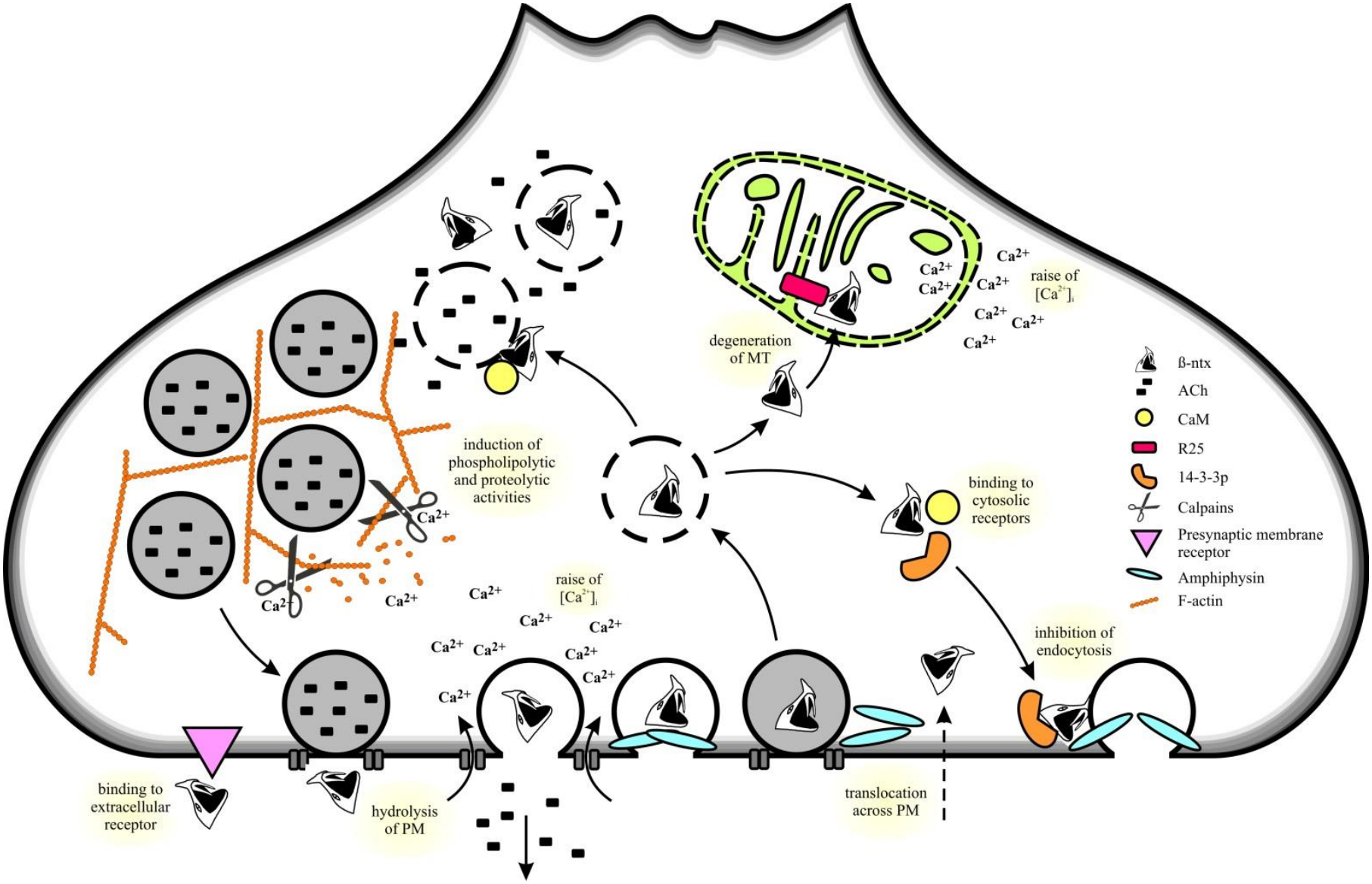
ammodytoxin

Nose-horned viper (*Vipera ammodytes ammodytes*)

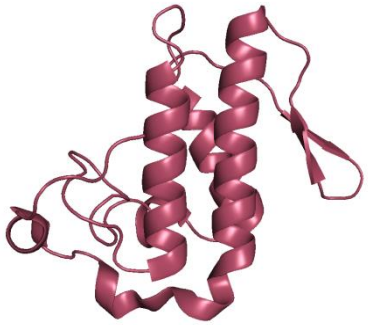




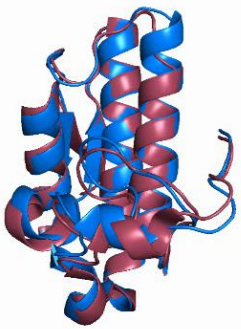
→ paralysis

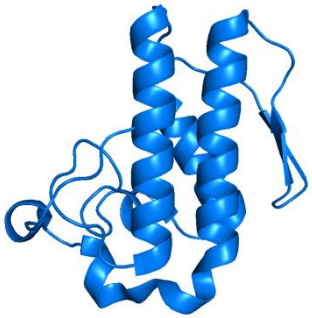


Šribar et al. (2014) *Toxicon* 89, 9.

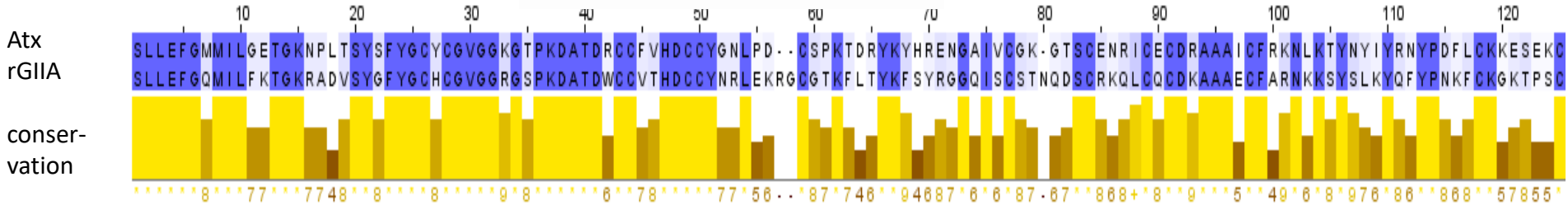


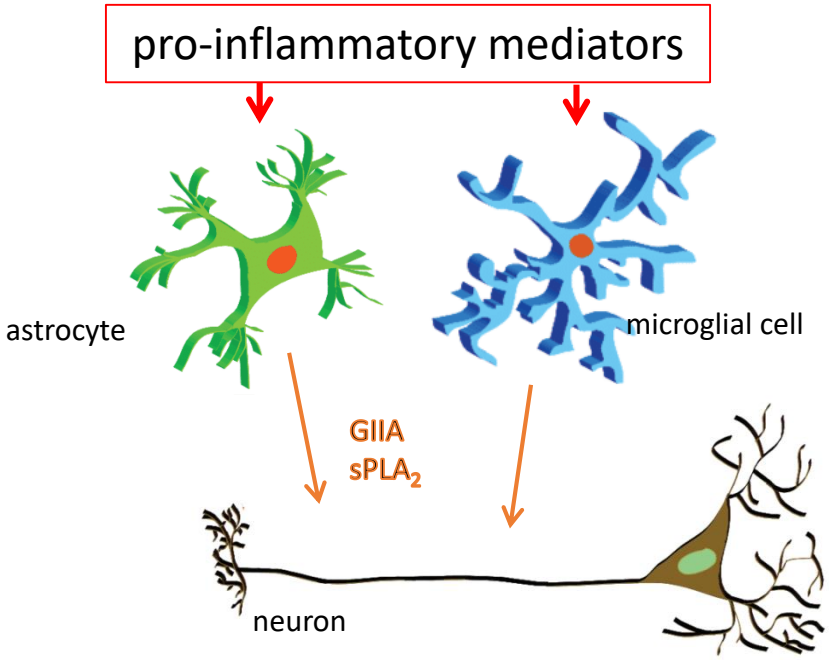
ammodytoxin





mammalian GIIA





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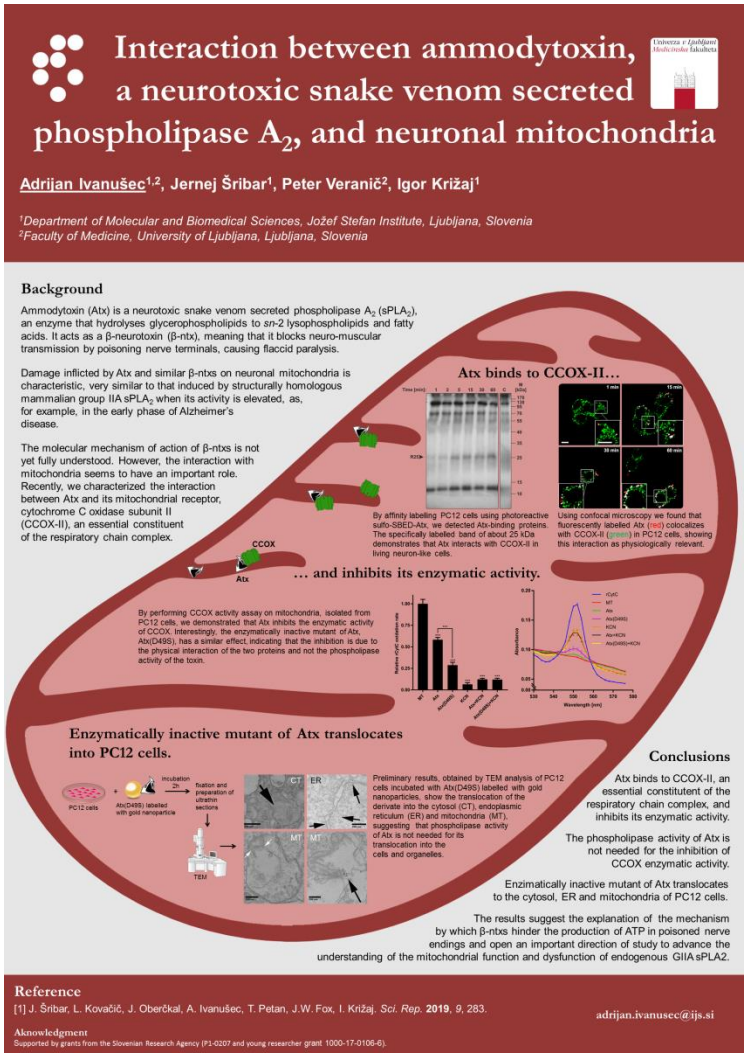

Interaction between ammodytoxin, a neurotoxic snake venom secreted phospholipase A_2, and neuronal mitochondria

Adrijan Ivanušec[1,2], Jernej Šribar[1], Peter Veranič[2], Igor Križaj[1]

[1]Department of Molecular and Biomedical Sciences, Jožef Stefan Institute, Ljubljana, Slovenia
[2]Faculty of Medicine, University of Ljubljana, Ljubljana, Slovenia

Background

Ammodytoxin (Atx) is a neurotoxic snake venom secreted phospholipase A_2 (sPLA$_2$), an enzyme that hydrolyses glycerophospholipids to *sn*-2 lysophospholipids and fatty acids. It acts as a β-neurotoxin (β-ntx), meaning that it blocks neuro-muscular transmission by poisoning nerve terminals, causing flaccid paralysis.

Damage inflicted by Atx and similar β-ntxs on neuronal mitochondria is characteristic, very similar to that induced by structurally homologous mammalian group IIA sPLA$_2$ when its activity is elevated, as, for example, in the early phase of Alzheimer's disease.

The molecular mechanism of action of β-ntxs is not yet fully understood. However, the interaction with mitochondria seems to have an important role. Recently, we characterized the interaction between Atx and its mitochondrial receptor, cytochrome C oxidase subunit II (CCOX-II), an essential constituent of the respiratory chain complex.

CCOX

Atx

Atx binds to CCOX-II…

By affinity labelling PC12 cells using photoreactive sulfo-SBED-Atx, we detected Atx-binding proteins. The specifically labelled band of about 25 kDa demonstrates that Atx interacts with CCOX-II in living neuron-like cells.

Using confocal microscopy we found that fluorescently labelled Atx (red) colocalizes with CCOX-II (green) in PC12 cells, showing this interaction as physiologically relevant.

… and inhibits its enzymatic activity.

By performing CCOX activity assay on mitochondria, isolated from PC12 cells, we demonstrated that Atx inhibits the enzymatic activity of CCOX. Interestingly, the enzymatically inactive mutant of Atx, Atx(D49S), has a similar effect, indicating that the inhibition is due to the physical interaction of the two proteins and not the phospholipase activity of the toxin.

Enzymatically inactive mutant of Atx translocates into PC12 cells.

PC12 cells

Atx(D49S) labelled with gold nanoparticle

Incubation 2h

fixation and preparation of ultrathin sections

TEM

CT ER MT MT

Preliminary results, obtained by TEM analysis of PC12 cells incubated with Atx(D49S) labelled with gold nanoparticles, show the translocation of the derivate into the cytosol (CT), endoplasmic reticulum (ER) and mitochondria (MT), suggesting that phospholipase activity of Atx is not needed for its translocation into the cells and organelles.

Conclusions

Atx binds to CCOX-II, an essential constitutent of the respiratory chain complex, and inhibits its enzymatic activity.

The phospholipase activity of Atx is not needed for the inhibition of CCOX enzymatic activity.

Enzimatically inactive mutant of Atx translocates to the cytosol, ER and mitochondria of PC12 cells.

The results suggest the explanation of the mechanism by which β-ntxs hinder the production of ATP in poisoned nerve endings and open an important direction of study to advance the understanding of the mitochondrial function and dysfunction of endogenous GIIA sPLA2.

Reference

[1] J. Šribar, L. Kovačič, J. Oberčkal, A. Ivanušec, T. Petan, J.W. Fox, I. Križaj. *Sci. Rep.* **2019**, *9*, 283.

adrijan.ivanusec@ijs.si

Aknowledgment

Supported by grants from the Slovenian Research Agency (P1-0207 and young researcher grant 1000-17-0106-6).

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Shape control and mechanism investigation

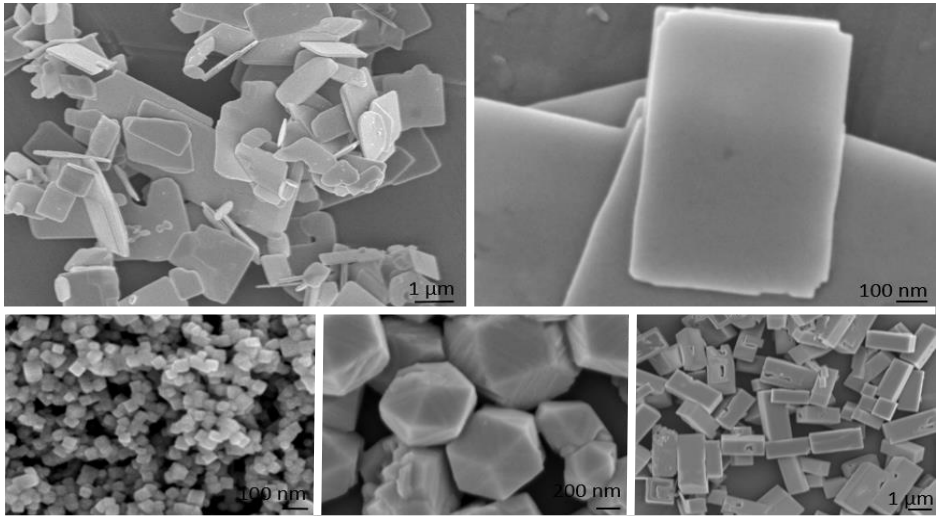
Mechanism of Topochemical Conversion of $Bi_4Ti_3O_{12}$ Plates to $SrTiO_3$ Plates under Hydrothermal Conditions

Alja Čontala

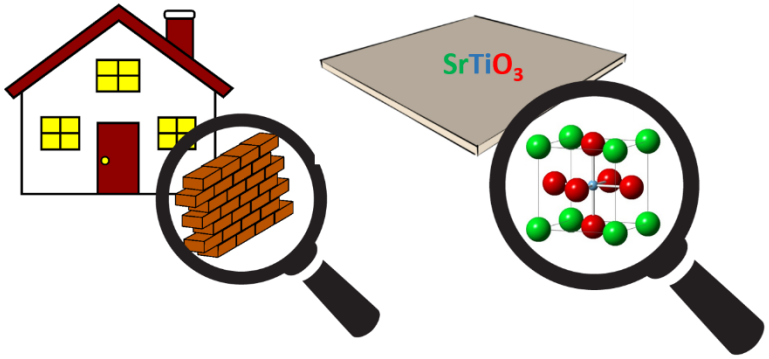
Advanced Materials Department (K9) JSI

Poster number: 25

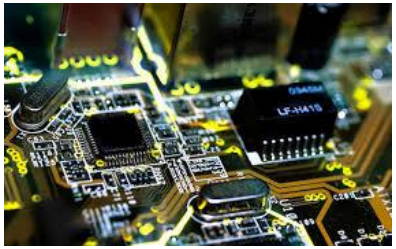
Synthesis – morphology - properties

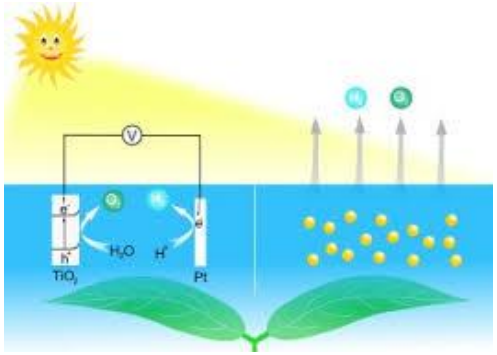


Crystal structure and preferential orientation



Application





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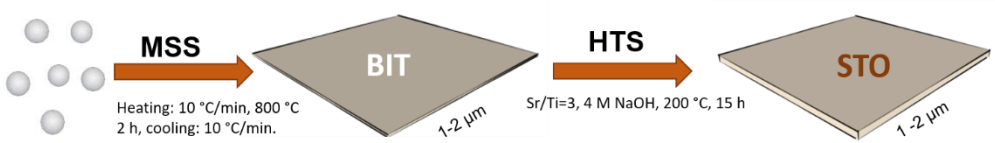
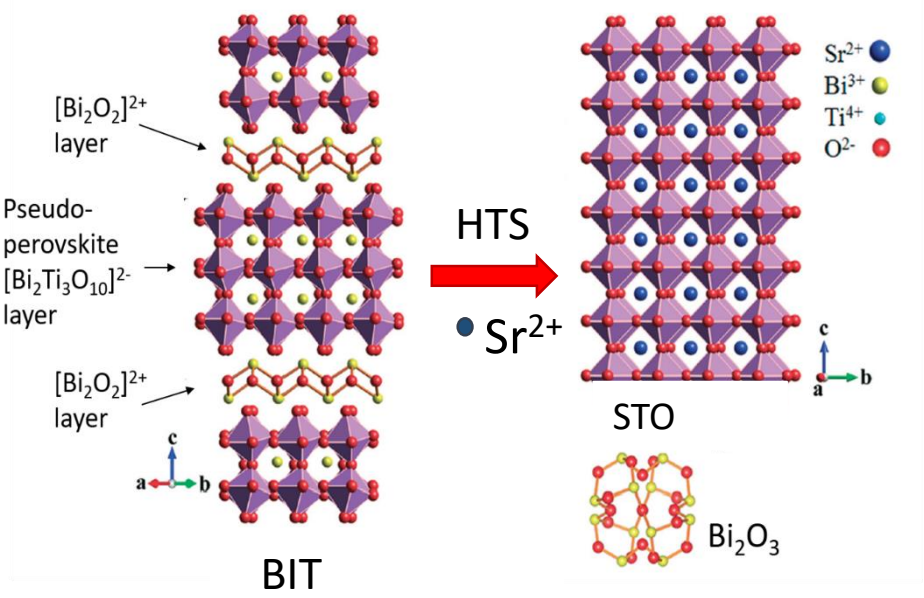
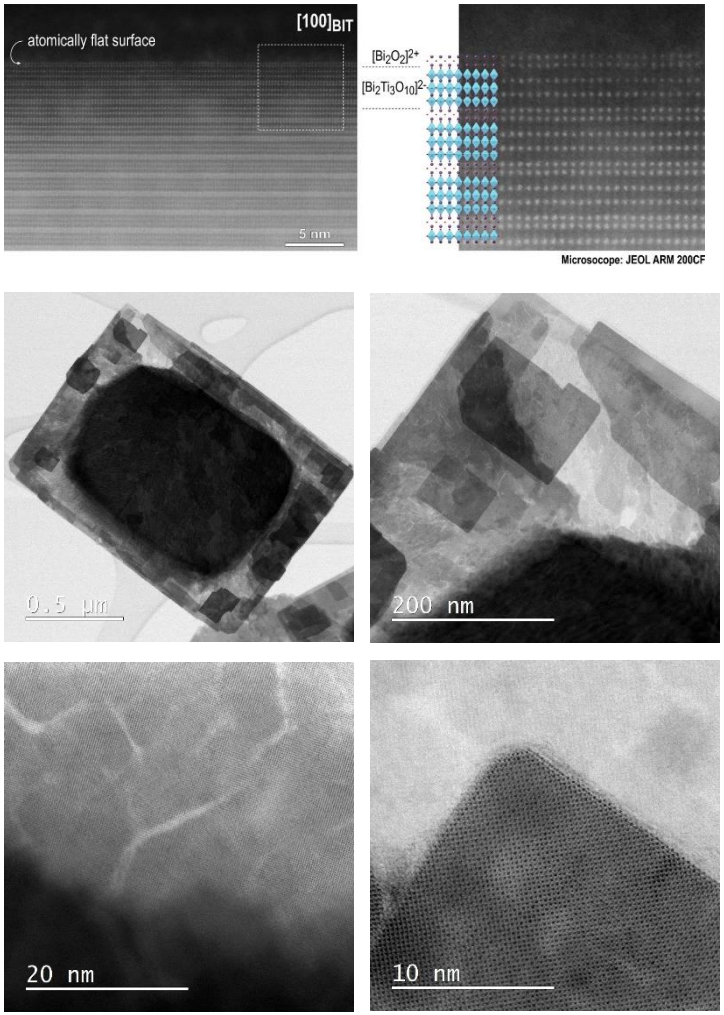
Synthesis:





Examination of the mechanism by TEM:



Poster number: 25

You can find me by the poster number

25

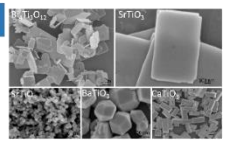
Mechanism of Topochemical Conversion of $Bi_4Ti_3O_{12}$ Plates to $SrTiO_3$ Plates under Hydrothermal Conditions

Alja ČONTALA[1,2], Nina DANEU[1], Matjaž SPREITZER[1] and Marjeta MAČEK KRŽMANC[1]

[1] Advanced Materials Department, "Jožef Stefan" Institute, Jamova 39, Ljubljana, Slovenia
[2] Jožef Stefan International Postgraduate School (Nanosciences and Nanotechnologies), Jamova 39, Ljubljana, Slovenia

MOTIVATION

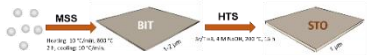
The synthesis of anisotropically shaped $MTiO_3$ (M= Ca, Sr, Ba) particles is a great challenge, because these particles tend to grow in cube- or sphere-like rather than in anisotropic shape due to the high symmetry of their crystal structure at the formation temperature. Different approaches to control the shape and size of ABO_3–type perovskites were reported, including topochemical conversion.[1]-[6] In this study, $SrTiO_3$ (STO) was chosen as a model system. Understanding the mechanism of topochemical conversion of $Bi_4Ti_3O_{12}$ (BIT) template platelets to STO platelets is of great interest, because the morphological characteristcs influence the material's electrical and optical properties.



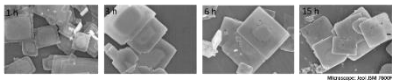
Perovskite particles

SYNTHESIS

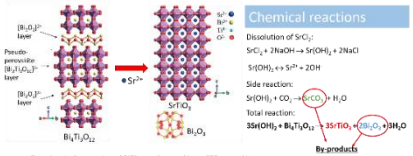
1. $Bi_4Ti_3O_{12}$ (BIT) synthesis in molten KCl/NaCl salt (MSS) at 800 °C for 2 h.
2. Washing with H_2O, 2 M HNO_3 and again with H_2O, freeze-drying.
   → Characterisation using SEM, TEM, XRD, DSC, BET.
3. Topochemical synthesis of $SrTiO_3$ (STO) from $Bi_4Ti_3O_{12}$ under hydrothermal conditions (HTS).
4. Washing with H_2O, 1 M HNO_3 and again with H_2O, freeze-drying.
   → Characterisation using SEM, TEM, EDS, XRD, DSC.



REACTION MECHANISM



SEM micrographs of nanoplatelets after 1, 3, 6 and 15 hours of conversion



Topochemical conversion of BIT layered perovskite to STO perovskite

Chemical reactions

Dissolution of $SrCl_2$:

$SrCl_2 + 2NaOH \rightarrow Sr(OH)_2 + 2NaCl$

$Sr(OH)_2 \leftrightarrow Sr^{2+} + 2OH^-$

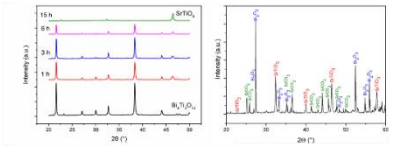
Side reaction:

$Sr(OH)_2 + CO_2 \rightarrow SrCO_3 + H_2O$

Total reaction:

$3Sr(OH)_2 + Bi_4Ti_3O_{12} \rightarrow 3SrTiO_3 + 2Bi_2O_3 + 3H_2O$

By-products



XRD diffractograms (on Si monocrystal) of (00l)-oriented BIT nanoplatelets and (h00)-oriented STO nanoplatelets with different amount of BIT residues after 1, 3, 6 and 15 hours of reaction (left) and STO sample before washing with 1 M HNO_3 (right)

Acknowledgements:

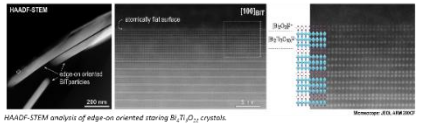
M-era.Net

Slovenian Research Agency

The authors acknowledge the project J2-6753 and the M-era.Net project 3184 HarvEnPlez, which were financially supported by the Slovenian Research Agency and the Ministry of Higher Education Science and Technology, respectively.

TEM ANALYSIS

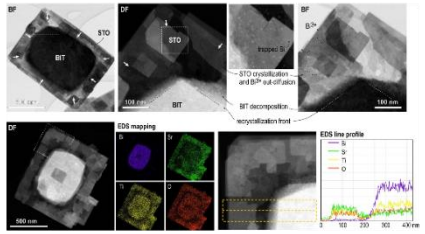
Starting BIT crystals



HAADF-STEM analysis of edge-on oriented staring $Bi_4Ti_3O_{12}$ crystals.

- The surface of BIT particles is atomically flat and BIT platelets are $(Bi_2O_2)^{2-}$ layer terminated.
- No defects are observed in BIT platelets.

BIT partially transformed to STO



STEM/EDS analysis of partially recrystallized BIT platelets to reveal recrystallization mechanism under HT conditions.

- BIT plates start to recrystallize to STO from the edges, recrystallization continues towards the center of the crystals.
- Many nucleation sites are formed around the initial BIT platelets.
- Nanocrystallites of STO grow along pseudo perovskite layers of BIT.
- Bi^{3+} diffuses out of the structure through „exchange channels". Traces of Bi^{3+} remains trapped between formed STO nanocrystallites.
- Converted STO resembles mesocrystalline assembly of oriented nanocrystallites.

CONCLUSIONS

- **STO nano-platelets** were prepared from BIT template platelets under hydrothermal conditions and the morphology was preserved.
- This is **the first study** of the mechanism of the topochemical conversion of BIT to STO under hydrothermal conditions.
- **Understanding this mechanism** is important for preparation **of other $MTiO_3$** (M= Ca, Ba) perovskite nanoplatelets using this template and method.

References:

[1] Zhang P., Ochi T., Fujitsuka M., et al. *Angew Chemie*. **2017**, *56*, 5299-5303.
[2] Cao J., Huang X., Liu Y., Wu J., Ji Y., *Mater Res Express*. **2016**, *3*, 5903-5911.
[3] Hu D., Mu H., Tanaka Y., Zhao L., Feng Q., *Chem Mater*. **2015**, *24*, 4983-4994.
[4] Zhang Y., Zhong L., Duan D., *J Mater Sci*. **2016**, *51*, 1142-1152.
[5] Wu J., Chang Y., Lv W., et al. *CrystEngComm*. **2018**, *20*, 3084-3095.
[6] Čontala A., Maček Kržmanc M., Suvorov D., *Acta Chim. Slov.* **2018**, *65*, 630-637.

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Milk as an «imprinting» of the area of origin: the case study of Parmigiano Reggiano cheese

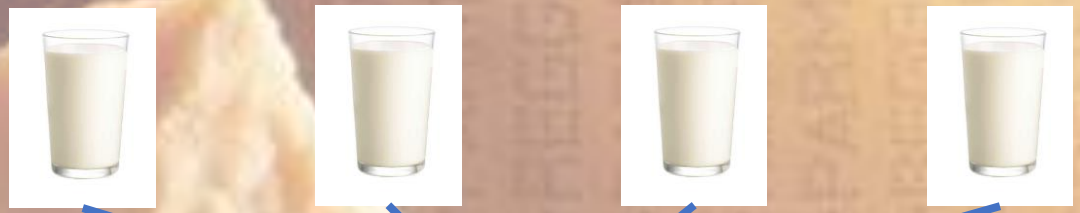
Marta Boito

[1]*Department of S.C.V.S.A., University of Parma*

[2]*Jožef Stefan Institute*

Poster number: 28

Milk n°1 | Milk n°2 | Milk n°3 | Milk n°..



Origin of raw materials?

Parmigiano Reggiano cheese: Protected Designation of Origin (**PDO**)

CARIPARMA CRÉDIT AGRICOLE

PARMIGIANO REGGIANO CONSORZIO TUTELA

^{a}Xz Isotopes → Stable isotopes

To check the authenticity and geographical origin of food

Aim: analysis of stable isotope ratios

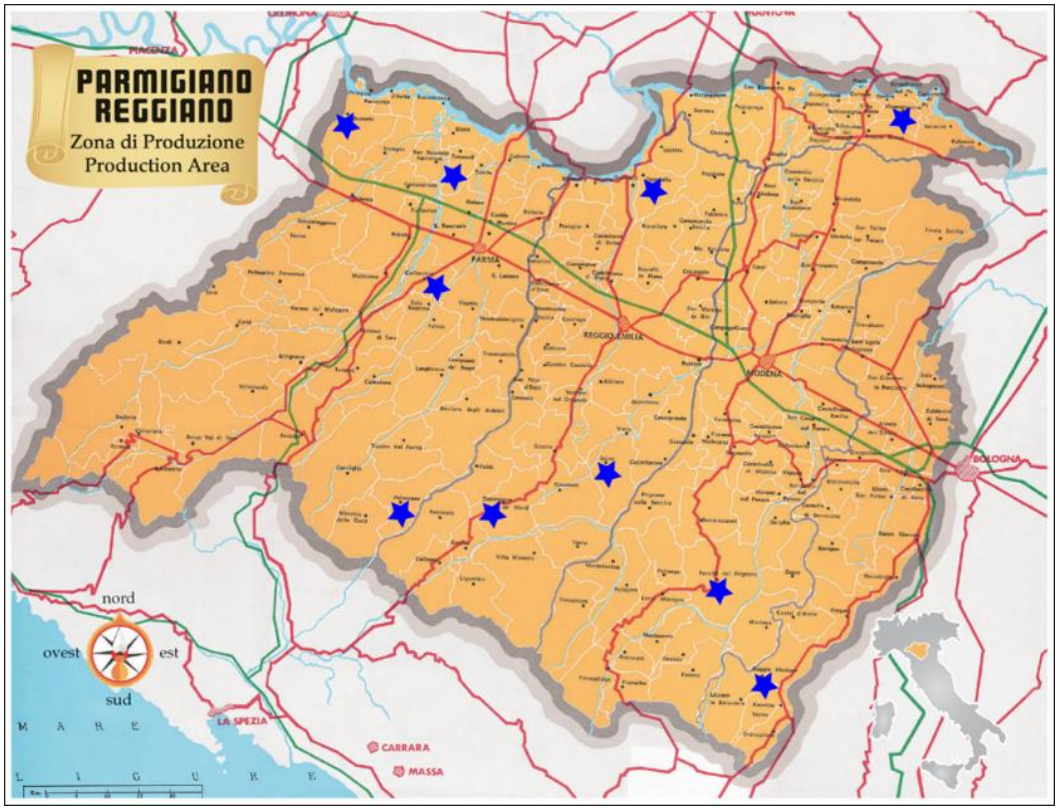
$^{18}O/^{16}O$ $^{2}H/^{1}H$ $^{13}C/^{12}C$ $^{15}N/^{14}N$

To plan a predictive model for the origin of milk - groundwater and feed -

- Environmental characteristics

★ **10** cattlesheds plain hill mountain

Monthly sampling: from February 2018 to January 2019

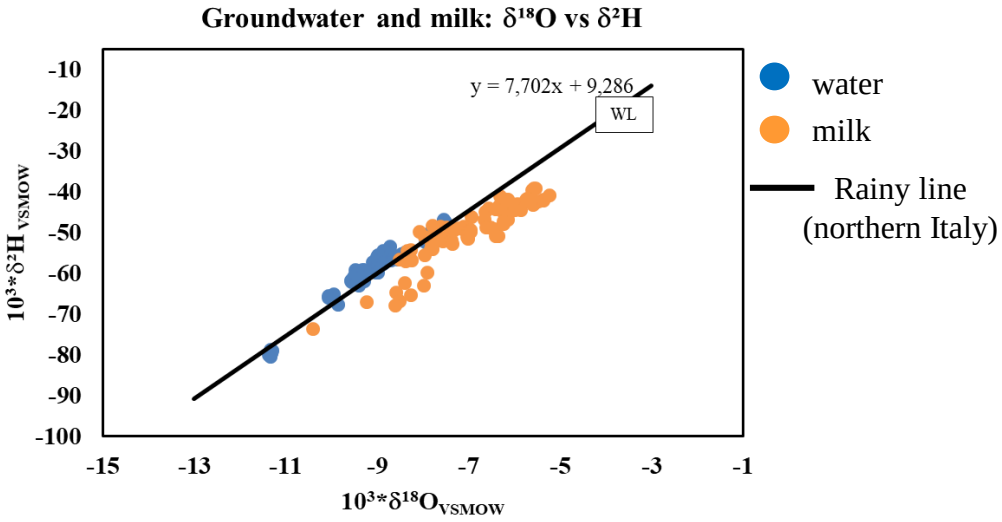


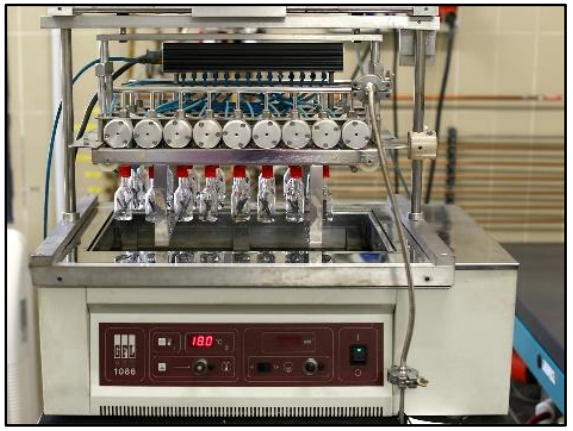
Source: Parmigiano Reggiano Consortium

- $^{13}C/^{12}C$, $^{15}N/^{14}N$: hay and fodder
- $^{18}O/^{16}O$, $^{2}H/^{1}H$: groundwater
- $^{18}O/^{16}O$, $^{2}H/^{1}H$: milk

Preliminary data

- 10 cattlesheds



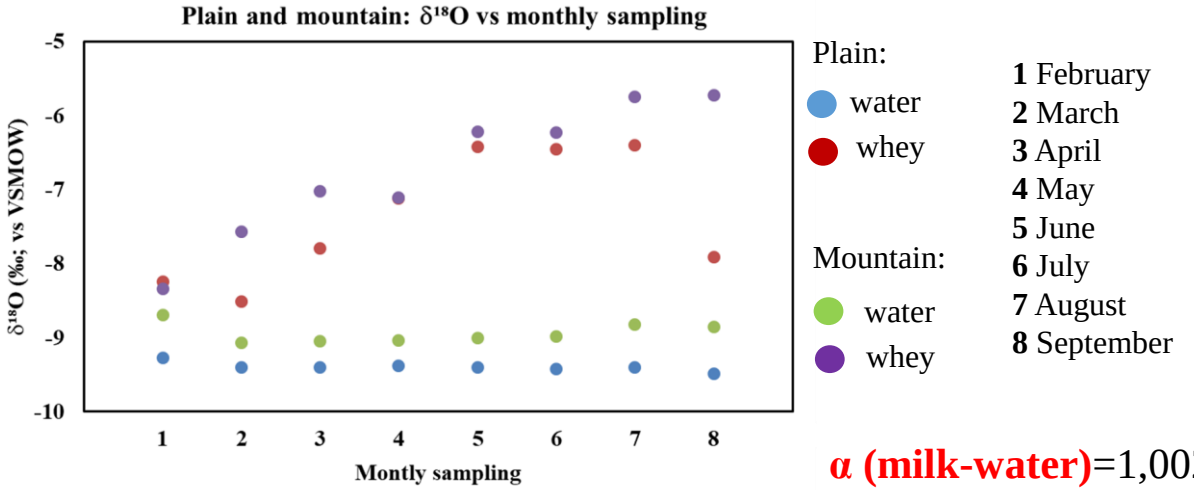


Automatic device-HDO-IRMS
($\delta^{18}O \pm 0.05‰$; $\delta^{2}H \pm 1‰$)

- 2 cattlesheds

plain

mountain



α (milk-water)=1,00211

$^{18}O/^{16}O$ $^{2}H/^{1}H$

groundwater → milk → climatic factors

- Differentiation between plain and mountain milk
- Correlation between values belonging to the same cattleshed

In the future… 

Research of scientific and economic interest:

- **Food origin guarantee** (milk and fodder)
- **Food adulteration** (food fraud)

Poster number: 28

Thanks for the kind attention!

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Development of Hydrogen Peroxide Gas Sensor for Security Applications

Jelena Isailović[1], P. Jovanovič[2], V. Jovanovski[1]

[1] *Department of Analytical Chemistry, National Institute of Chemistry, Ljubljana*

[2] *Department of Catalysis and Chemical Reaction Engineering, National Institute of Chemistry, Ljubljana*

Poster number: 36

Terror attacks

◦Prevent◦

The casualties and loss of human lives and historical monuments.

◦Protect◦

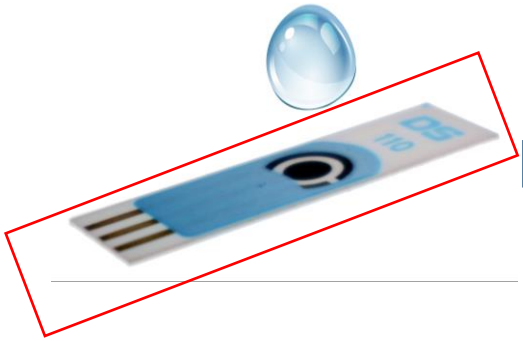
National intellectual properties, reduce vulnerability to attack by improving sensors for detection.

How are we contributing…

- By detecting H_2O_2 which is both precursor and degradation product of peroxo explosives.
- Using indirect method with MnO_2, we can see the presence of H_2O_2 in the gas phase, by the following scheme:

MnO_2 → (oxidation) H_2O_2 → (to) O_2 and H_2O

(to)

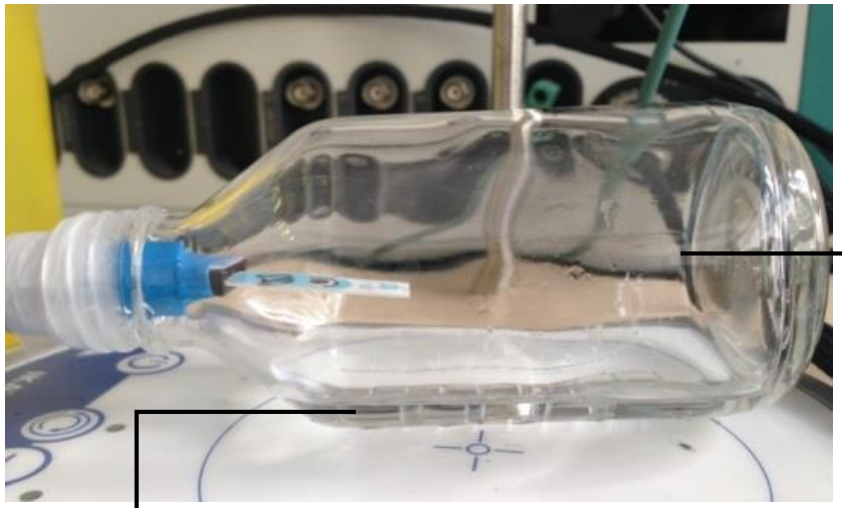


→ Electrochemical sensor

MnO and $Mn(OH)_3$ → (reoxidize) MnO_2

A lot more to improve…

- I am working with different screen printed electrodes, and different electrolytes, to find the best system which can detect gaseous peroxide in small concentrations, as fast as possible.



Thank you for your attention!

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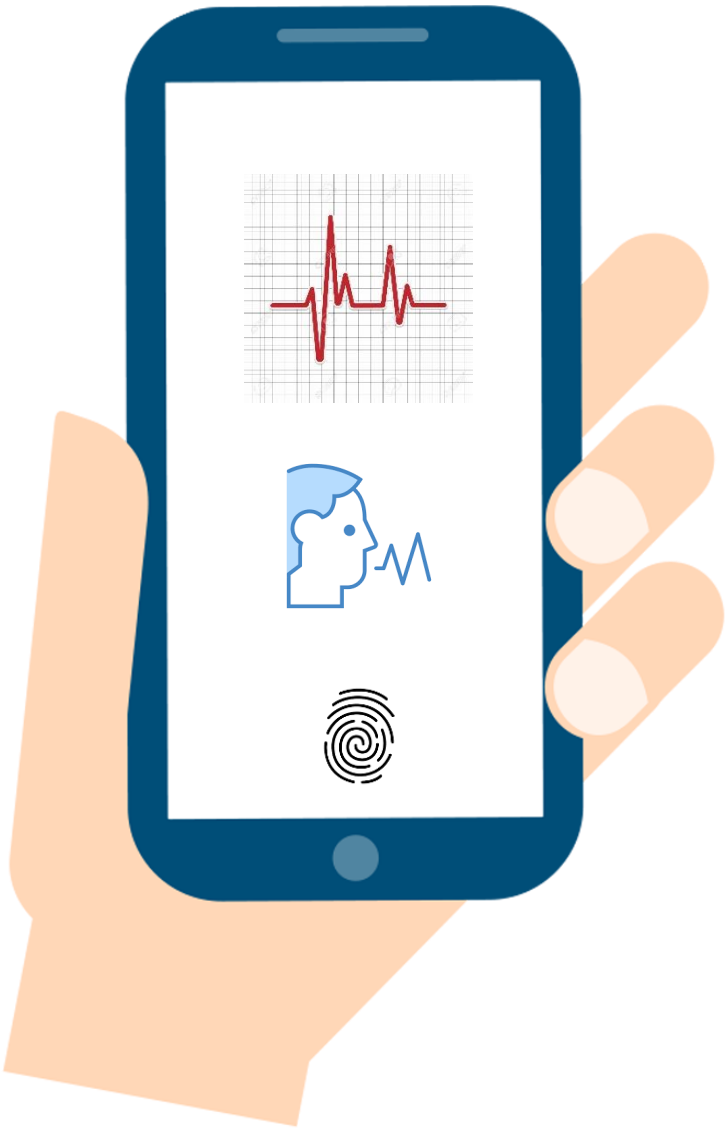
Compositional study of lead-free sodium potassium niobate based piezoelectric ceramics

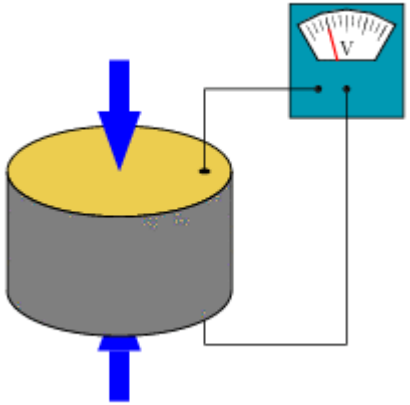
Oana Andreea Condurache,

[1]*Electronic Ceramics Department, Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia*

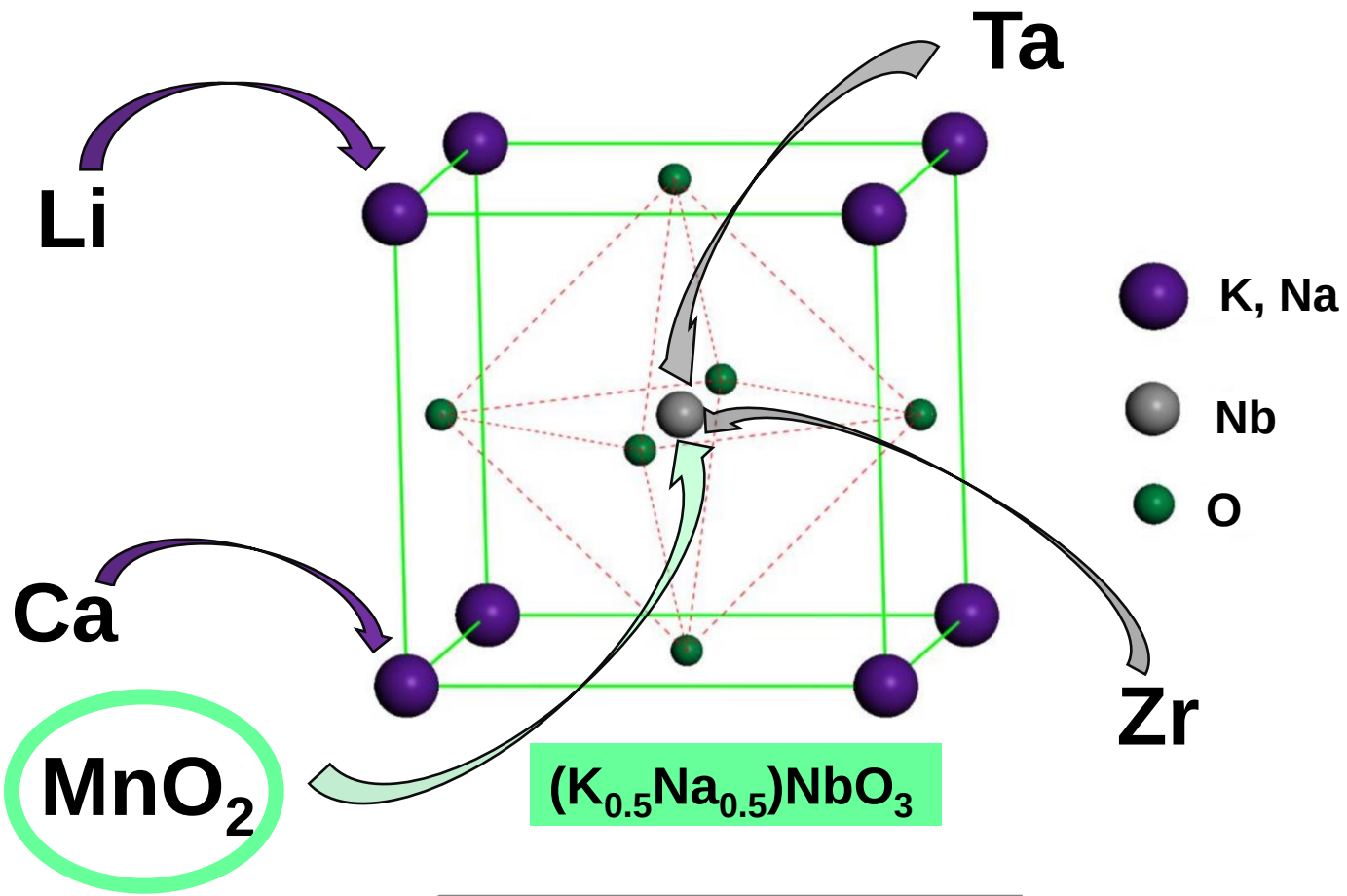
Poster number: 62

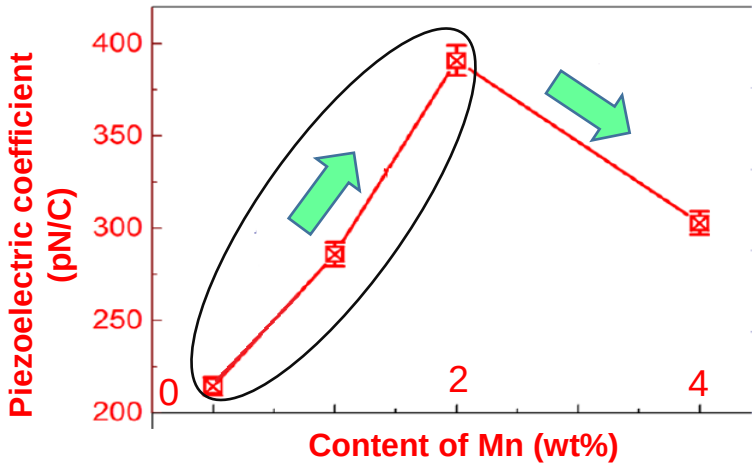


Piezoelectric effect



Mechanical energy ↔ Electrical energy

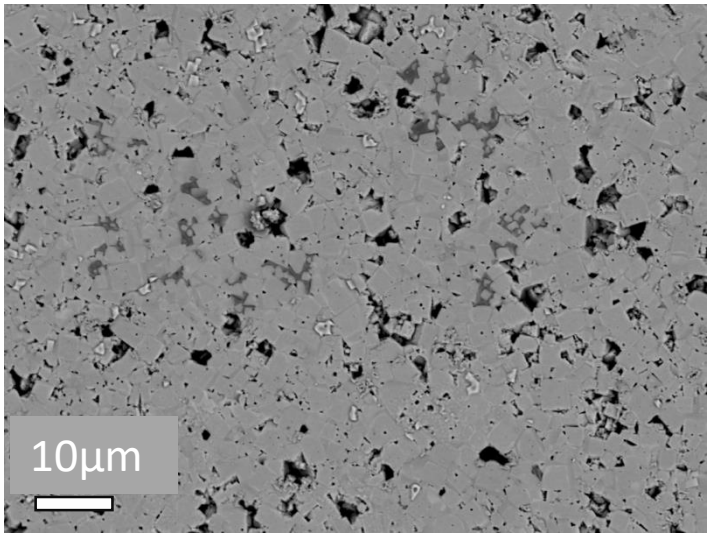


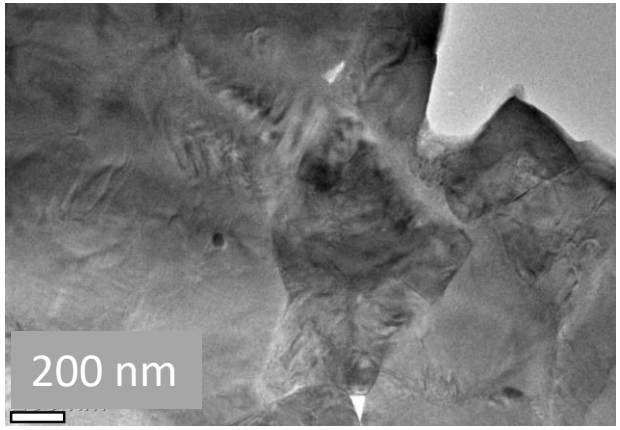


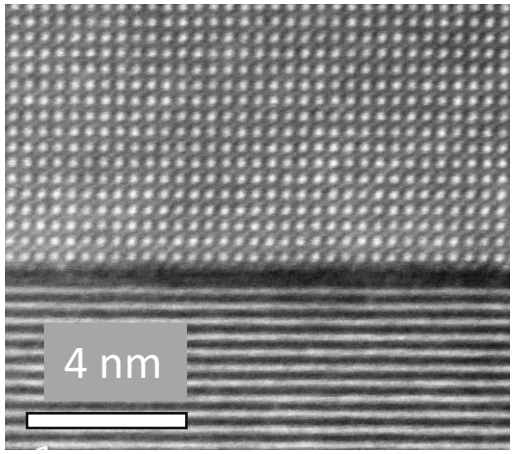
Yao et al., *ACS Appl. Mater. Interfaces 2018*, 10, 37298−37306

$0.95(K_{0.49}Na_{0.49}Li_{0.02})(Nb_{0.8}Ta_{0.2})O_3-0.05CaZrO_3$ with 2 wt % MnO_2 (KNLNT)

Micro level → **Nano level** → **Atomic level**

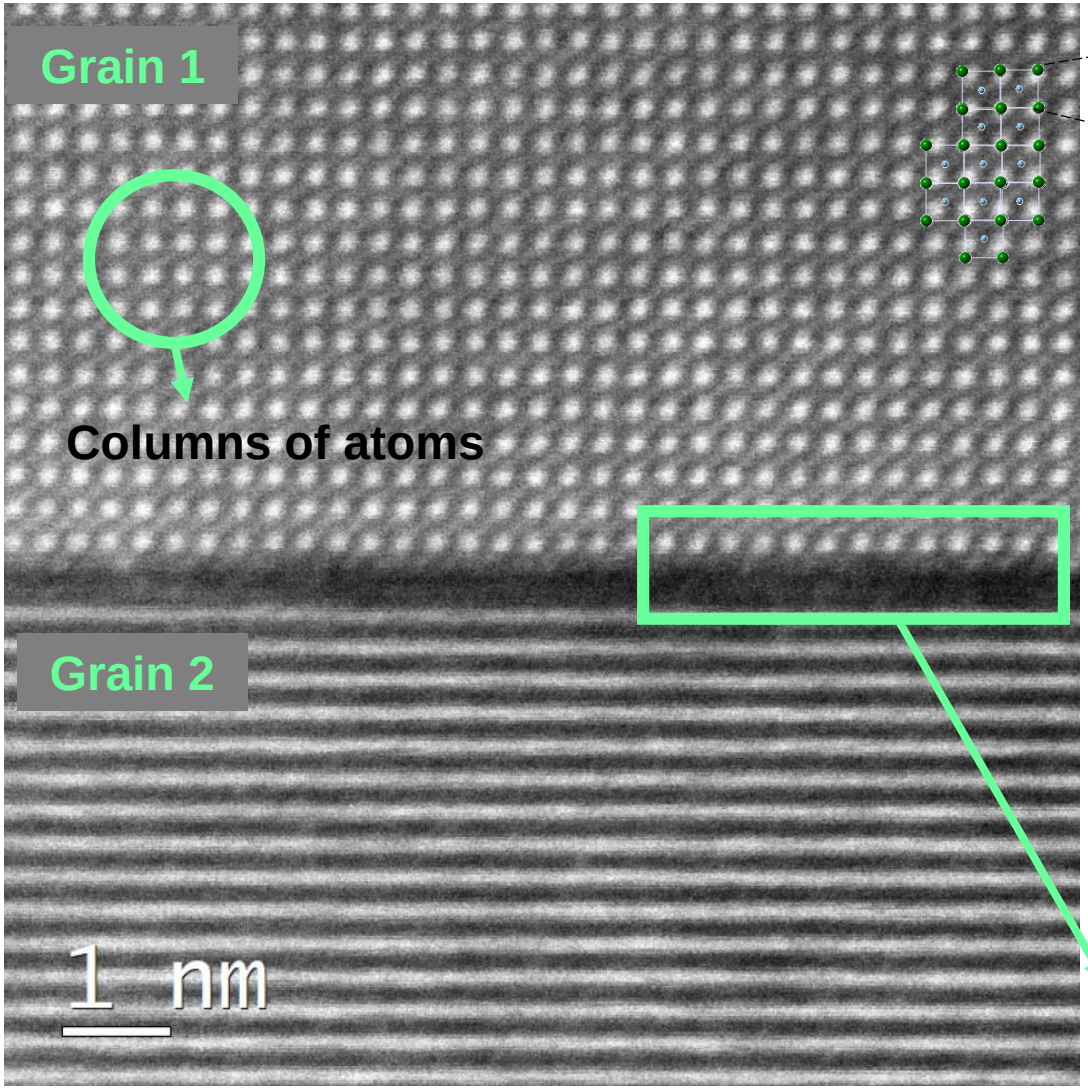


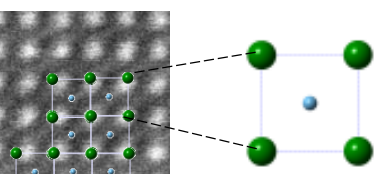




By SEM **By TEM** **By STEM**

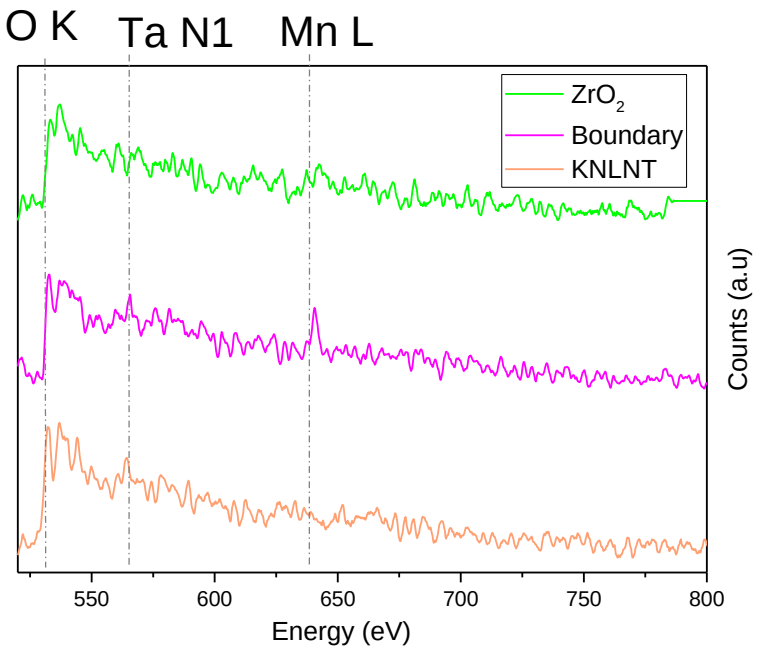
Is all about small things….
Small things change big things….





Nb

K, Na



Atomic layer of secondary phases

STEM image

Compositional study of lead-free sodium potassium niobate based piezoelectric ceramics

Oana Condurache[1,2], Kristian Radan[1], Brigita Kmet[1], Goran Dražić[1,2,3], Uroš Prah [1,2], Barbara Malič[1,2] and Andreja Benčan[1,2]

[1]Electronic Ceramics Department-K5, Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia
[2] Jožef Stefan International Postgraduate School, Jamova 39, 1000 Ljubljana, Slovenia
[3] National Institute of Chemistry, Hajdrihova 19, 1000 Ljubljana, Slovenia
oana.condurache@ijs.si Supervisor: prof. dr. Andreja Benčan

Introduction

Piezoelectrics are one of the key components of modern technology. However, commercial piezoelectric ceramics are in majority lead-based and consequently, toxic and environmentally unfriendly. Things must change! But how? A possible solution was given by Wang et al. [1] who reported piezoelectric properties comparable with lead-based materials in (K,Na,Li)(Nb,Ta)O_3-$CaZrO_3$ with 2 wt% MnO_2 (KNLNT-CZ-MnO_2). Notwithstanding, there is still room for understanding the relationship between synthesis route and properties.

The aim of the present work was to investigate the influence of the addition of MnO_2 either before (BC) or after the calcination step (AC) on the microstructure and chemical inhomogeneities in KNLNT-CZ-MnO_2 samples prepared by mechanochemical activation synthesis route (MCA) [2, 3] and, ultimately, understanding their influence on the functional macroscopic properties. For this purpose complementary microscopic techniques, combined with analytical tools were employed.

Homogenization of K_2CO_3 + Na_2CO_3 + Li_2CO_3 + Nb_2O_5 + Ta_2O_5 + $CaCO_3$ + ZrO_2

1) Planetary mill (ZrO_2-Y_2O_3 balls), 4 h, 200 rpm

2) MCA: High-energy milling (WC balls) 8 h, 300 rpm

MnO_2 BC

Calcination 4h, 800 °C

MnO_2 AC

Pressing 2h, 1150 °C or 1110 °C

Pressing Uniaxial pressing 50 MPa Isostatically pressing 300 MPa

Samples

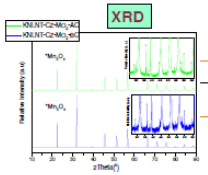
1. KNLNT-CZ with 2 wt% MnO_2 added before calcination (KNLNT-CZ-MnO_2 BC)
2. KNLNT-CZ with 2 wt% MnO_2 added after calcination (KNLNT-CZ-MnO_2 AC)

Characterization

- XRD • Electrical and piezoelectric properties • Density measurements
- Sample preparation for SEM (polishing and carbon coating) and for TEM (samples were grinded, dimpled and Ar-ion milled)
- Microstructure by SEM (Jeol JSM-7600F) (samples polished and carbon poailed)
- Structure analysis at nano- down to atomic level by (HR)TEM (Jeol JEM-2010F) and STEM (Jeol ARM 200 CF)
- Chemical composition analysed by EDXS and EELS analysis

Results

XRD



From quantitative Rietveld refinement:

Phases	Quantity (%) KNLNT-CZ-MnO_2 BC	KNLNT-CZ-MnO_2 AC
KNLNT orthorombic	41.84	51.07
KNLNT tetragonal	57.14	47.91
Mn_3O_4	1.22	1.02

Secondary phases detected from XRD.

Functional properties

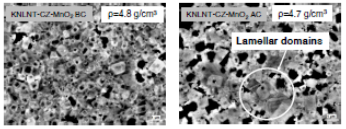
Electrical properties by Impedance analyzer
The coupling coefficient kp by resonance method
The d_{33} coefficient measured with a piezometer

Room Temperature
Frequency: 1 Hz

	KNLNT-CZ-MnO_2 BC	KNLNT-CZ-MnO_2 AC
Relative permittivity ε_r	1918	2132
Tangent losses tanδ	0.034	0.05
Conductivity σ (S/m)	$3.14*10^{-5}$	$2.37*10^{-5}$
Piezoelectric coefficient d_{33} (pC/N)	140	238
The coupling factor k_p (%)	27	40

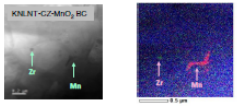
The piezoelectric properties are improved when MnO_2 is added after the calcination step.

Microstructure (by SEM)

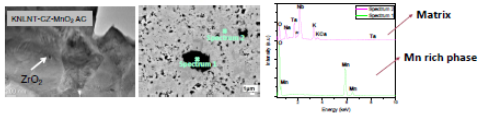


- Adding MnO_2 after calcination resulted in larger grains, and consequently, larger domains.

EDXS analysis by TEM and SEM



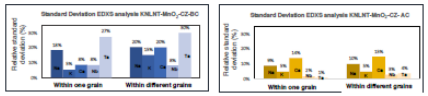
The EDXS analysis proved that there are two secondary phases that are not dissolving in the perovskite matrix: Zr rich and Mn rich.



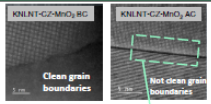
Slightly differences from the nominal composition in both samples.

	Na (at%)	K (at%)	Ca (at%)	Zr (at%)	Nb (at%)	Ta (at%)
KNLNT-CZ-MnO_2-BC (average of ~ 20 points)	7.20	8.51	0.97	0.71	16.47	4.02
KNLNT-CZ-MnO_2-AC (average of ~ 20 points)	7.18	8.35	1.06	0.81	15.88	4.62
Nominal Composition	9.31	9.31	1.00	1.00	15.20	3.80

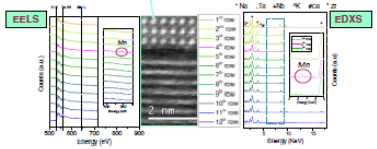
When adding MnO_2 after calcination, the sample is more homogeneous within a grain but also between grains in comparison with the sample in which MnO_2 was added before calcination.

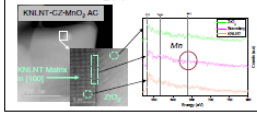


Grain boundaries analysis (STEM)



When the MnO_2 is added after calcination, an amorphous atomic layer of Mn rich phase is formed at grain boundaries.





Moreover, an amorphous atomic layer of Mn rich phase is formed at the boundary between ZrO_2 and the matrix.

Conclusions

- The step in which MnO_2 is added in the synthesis process can influence the structure and chemical homogeneity down to atomic level, and subsequently, the final functional properties.
- The sample for which the MnO_2 was added after the calcination step shows improved piezoelectric properties, however showing slightly enhanced dielectric losses (5% compared with 3.5%). A higher piezoelectric activity can be correlated with a higher degree of homogeneity, however the slight increase in the losses can be due to the presence of secondary phases at grain boundaries.

References

[1] K. Wang et al., *Adv. Funct. Mater.* **2013**, *23*, 4079–4086.
[2] T. Rojac et al., *Ceramics* **2018**, *1*, 304–318.
[3] K. Radan et al., *Ceramics* **2018**, *1*, 304–318.

Abbreviations

XRD: X-Ray Diffraction; SEM: Scanning Electron Microscopy; (HR)TEM: (High-Resolution) Transmission Electron Microscopy; STEM: Scanning Transmission Electron Microscopy; EDXS: Energy-Dispersive X-ray Spectroscopy; EELS: Electron Energy Loss Spectroscopy.

Acknowledgements

This work was funded by Slovenian Research Agency (PR-08978) and by Research Core Funding (P2-0105)

Poster no. 62

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15 and 16 April 2019, Planica

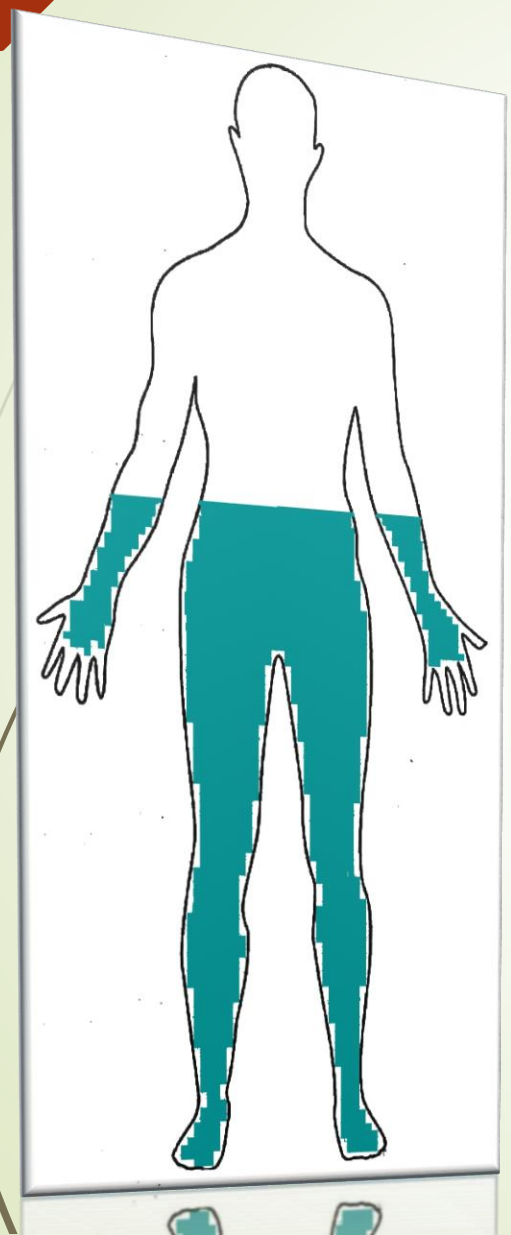
Authenticity and safety of food supplements in Slovenian market

Jasmina Masten,

Jožef Stefan International Postgraduate School,
Dept. of Environmental Sciences, Jožef Stefan Institute

Poster number: 57

Satisfying the need for nutrients



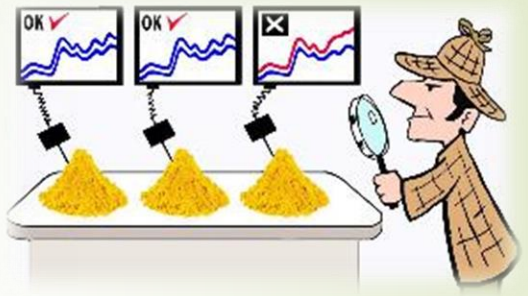
http://littledoglost.blogspot.com/

Poster number: 57

Quality and safety monitoring?

Inspection?

https://guardian.ng/



(Illustration Sorensen et al., 2018)

Authenticity?

https://www.eurofins.de/

Safety, quality?

https://ambical.com/

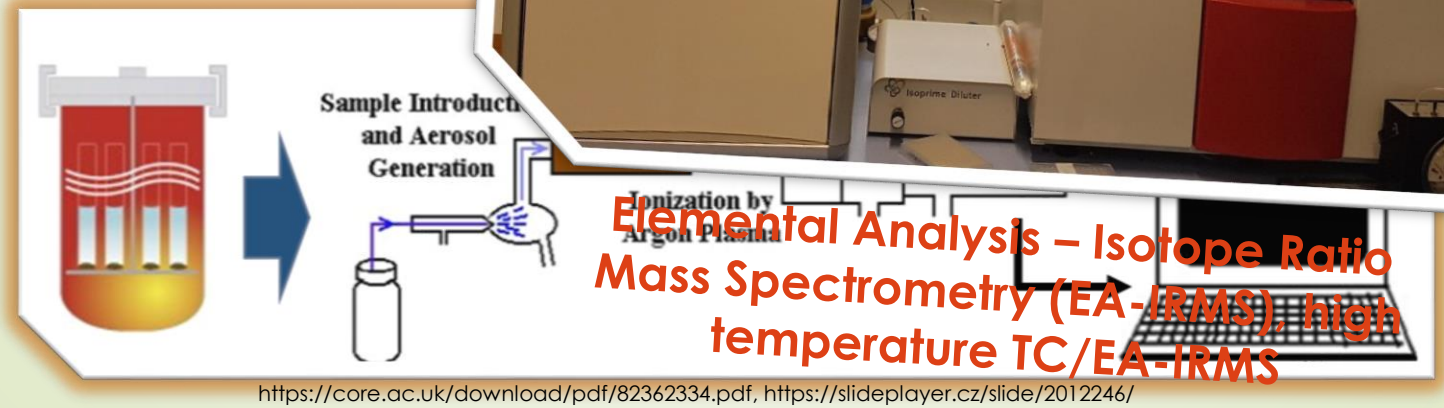
http://clipart-library.com/

Poster number: 57

Authenticity and safety: Stable isotope ratio and elemental analysis

X-Ray Fluorescence (XRF)

Inductively Couple

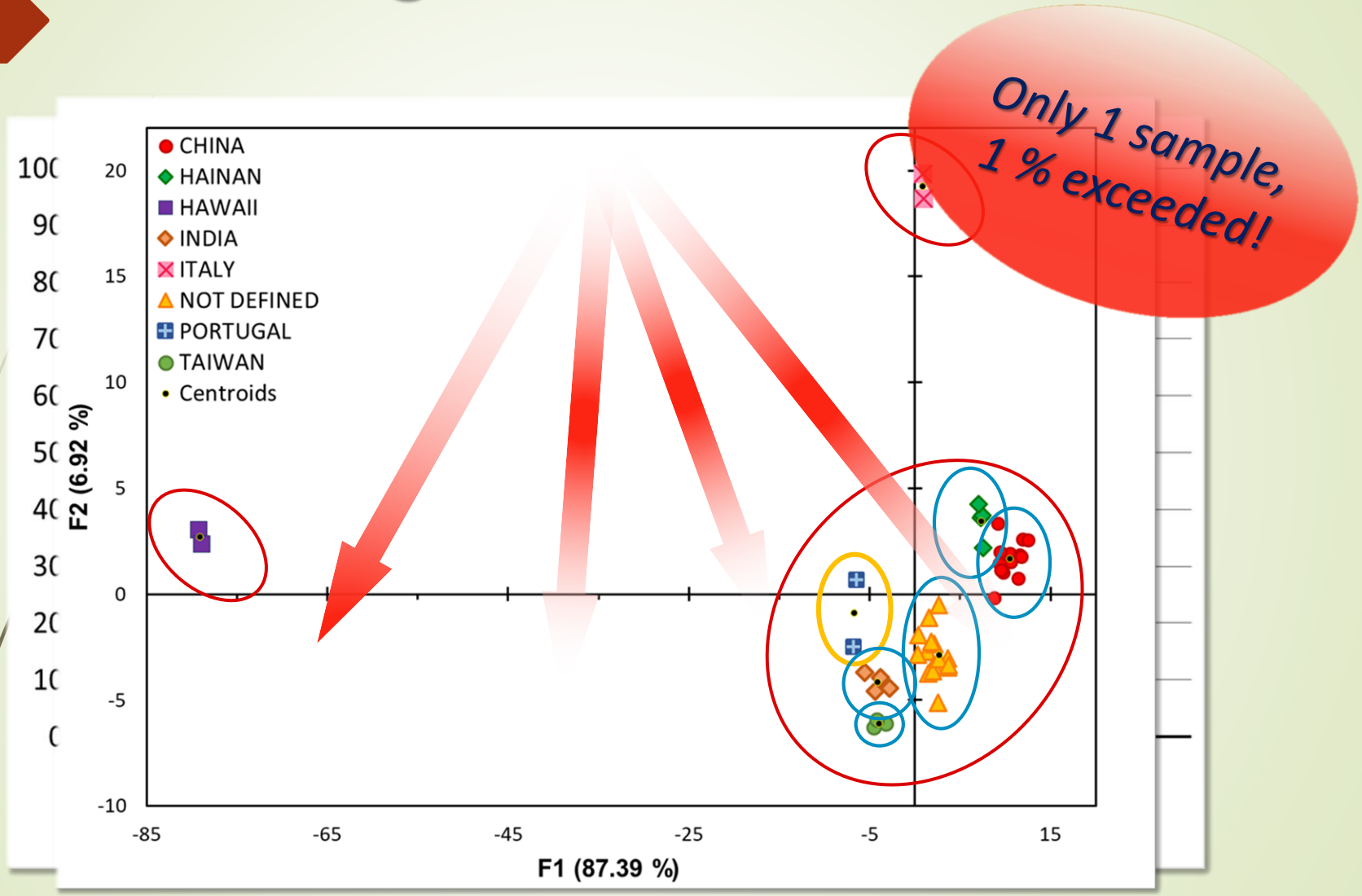


Elemental Analysis – Isotope Ratio Mass Spectrometry (EA-IRMS), high temperature TC/EA-IRMS

https://core.ac.uk/download/pdf/82362334.pdf, https://slideplayer.cz/slide/2012246/

Poster number: 57

Promising results!



Poster number: 57

Acknowledgements

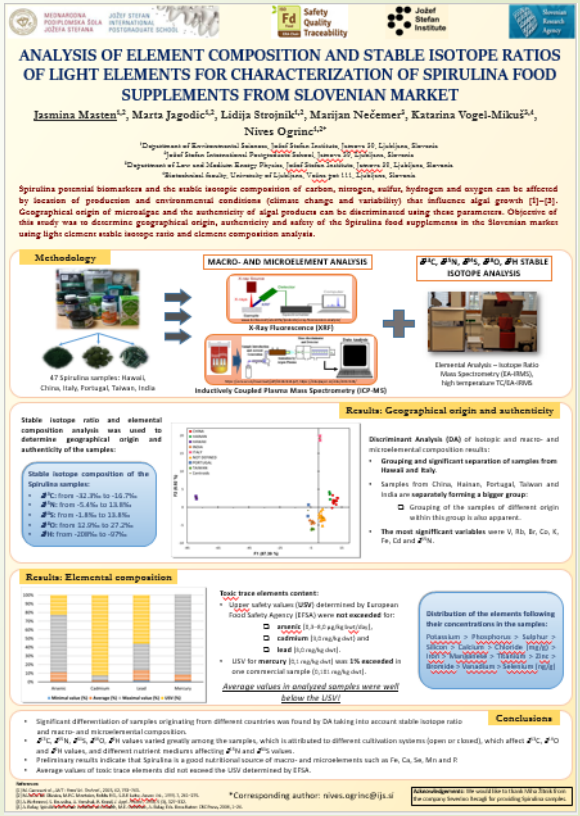
ISO Fd Food ERA Chair Safety Quality Traceability

Slovenian Research Agency

Medunarodna podiplomska šola Jožefa Stefana Slovenija Ljubljana 2004

University of Ljubljana Biotechnical Faculty

Jožef Stefan Institute



Thank you!

Poster number: 57

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15 and 16 April 2019, Planica

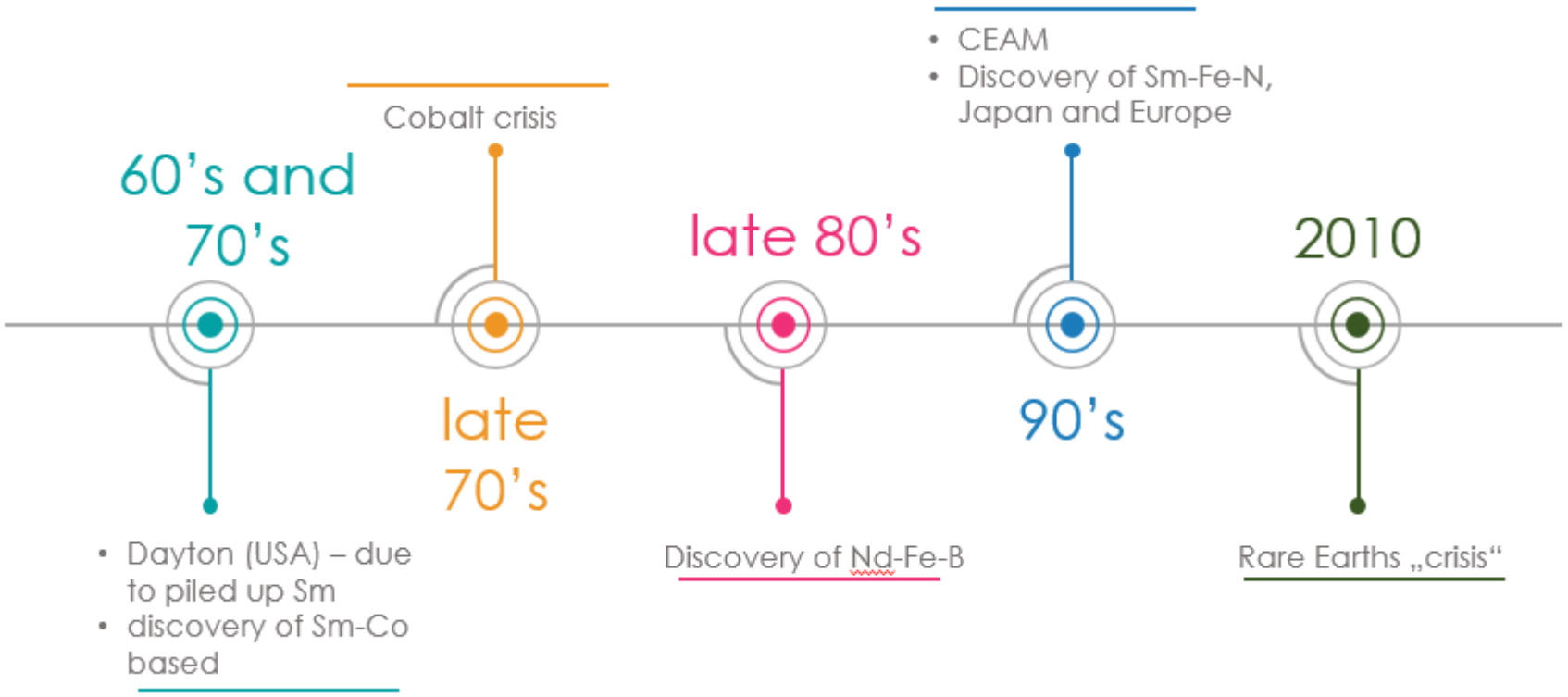
Corrosion protection of SmFeN magnetic materials

Ana Damnjanović

Kolektor Group, Si; MPS, Si

Poster number: 55

Development of Rare Earth based magnets



- corrosion costs 3%-4% of GDP
- between **US$375 and $875 billion** per year on a global basis could be saved

Future trends:

- Recycle RE materials
- No RE
- Extend life shell

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Bacterial degradation of plant biopolymers for making highly valuable products

Jutra Černilogar

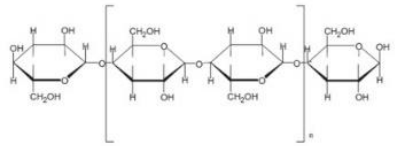
Jožef Stefan institute, Department of Environmental Science, Ljubljana, Slovenia

Jožef Stefan International Postgraduate School, Ljubljana, Slovenia

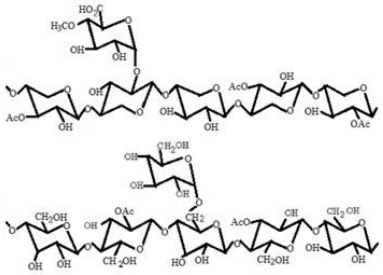
Poster number: 40

Plant biomass

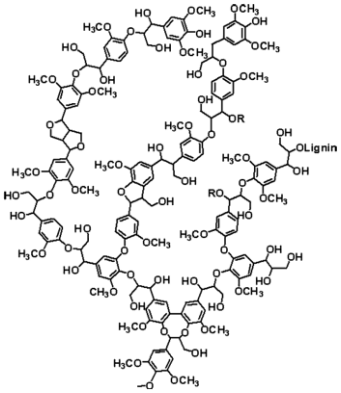
cellulose



hemicellulose



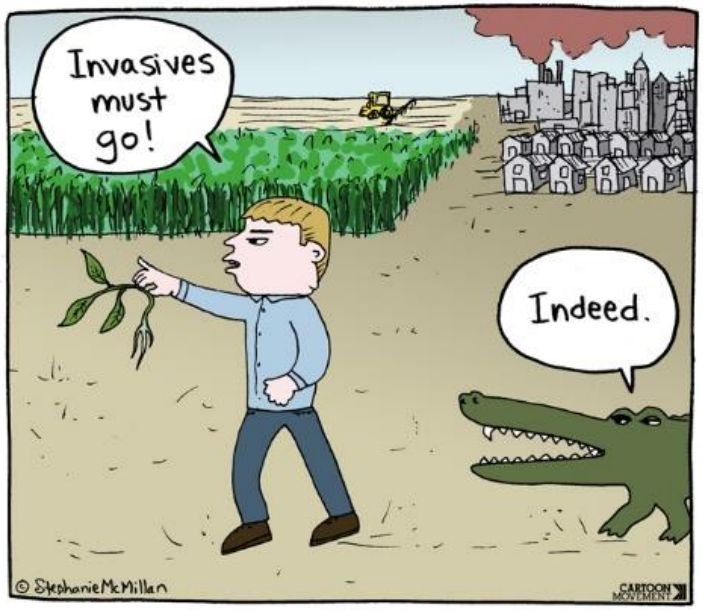
lignin



enzymes

- ferulic acid,
- vanillin,
- vanillic acid,…

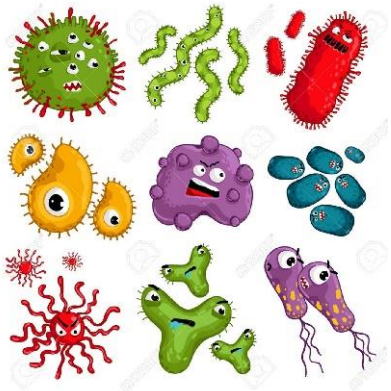
Invasive species



Harmful?

Eliminate it?

Like other plant biomass, they have a great potential!

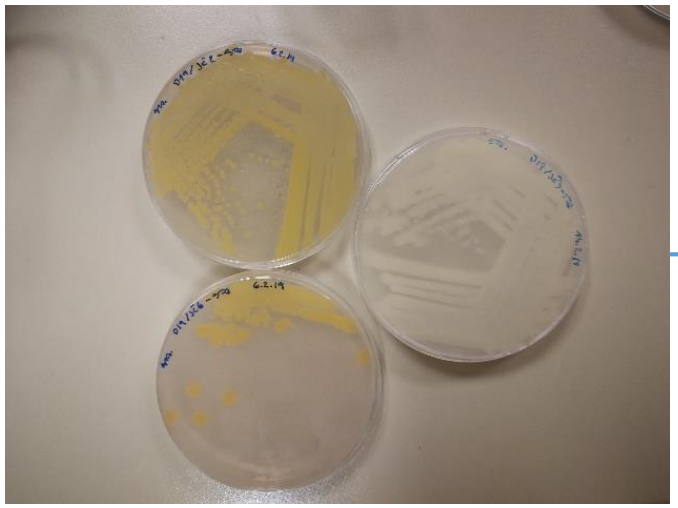


Ferulic acid, vanillin, vanillic acid,…

Benefits of invasive plants:

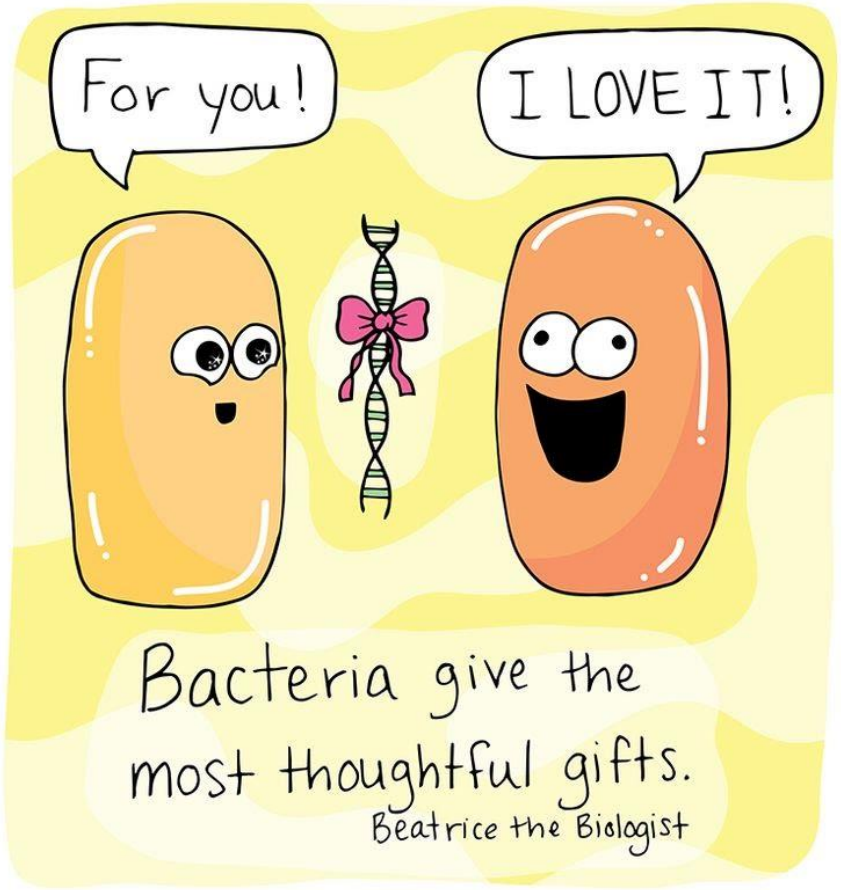
- growing fast → a lot of biomass
- easily accessible for use

Selective media



Enzymes with high activity to break lignin's bonds

THANK YOU FOR YOUR ATTENTION!



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Do we have to choose between our car and clean air?

Petra Stražar,

Institut Jožef Stefan

Poster number: 53

We have a solution?

- Creating a new material (catalyst) that will eliminate all sulphur in fossil fuels.
- Made out of cheep material (zinc oxide and nickel).
- Can be recycled!

Thank you for listening

Poster number 53 waits for you and your questions

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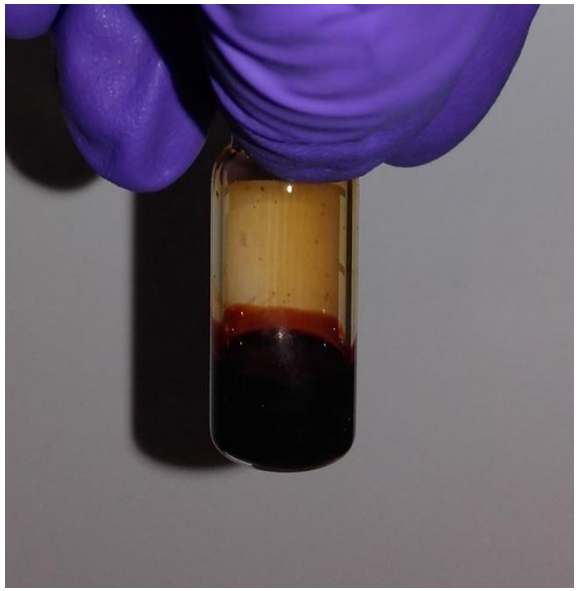
Liquid magnet

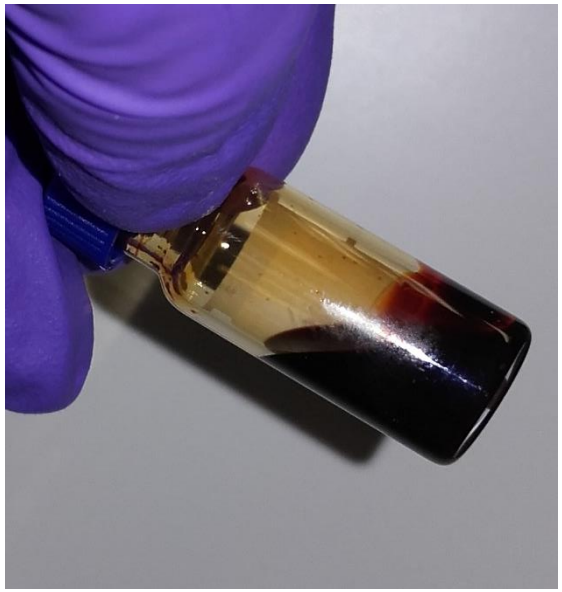
Patricija Hribar Boštjančič

Department of Complex Matter
Jožef Stefan IPS

Poster number: 10

Liquid magnet

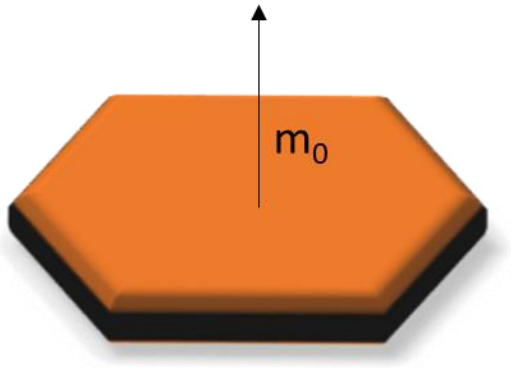




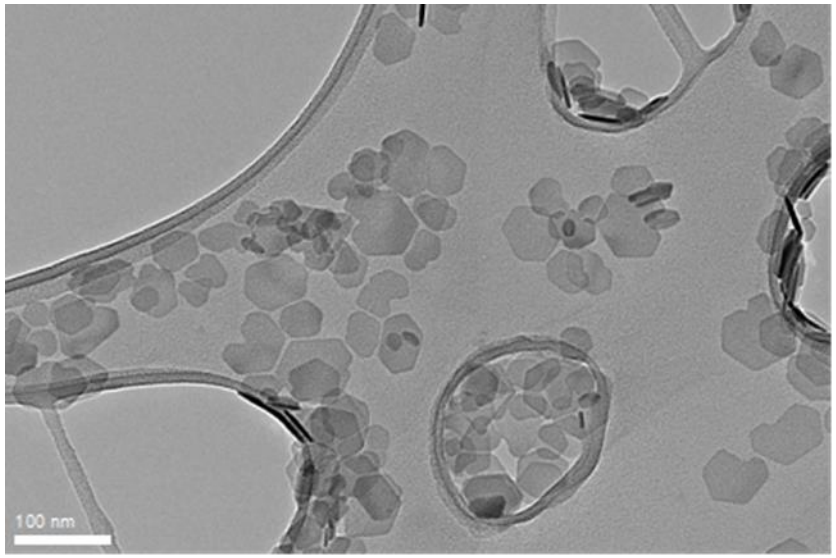
It is a dark brown liquid.

The liquid magnet composition

- Formation of a liquid magnet - barium hexaferrite (BHF) nanoplatelets + 1-butanol (concetrated) [1].



Barium hexaferrite nanoplatelet.

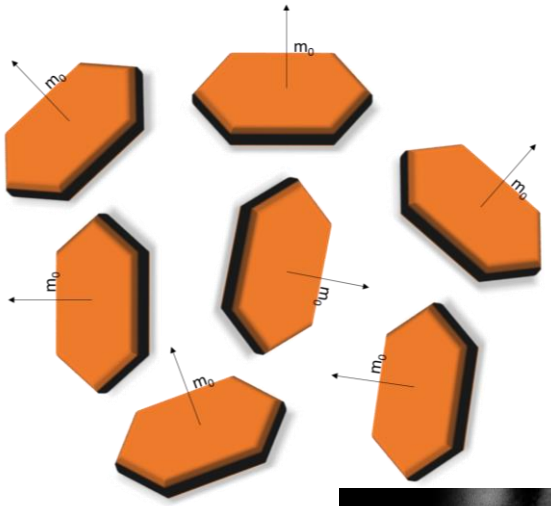


TEM image of barium hexaferrite nanoplatelets.

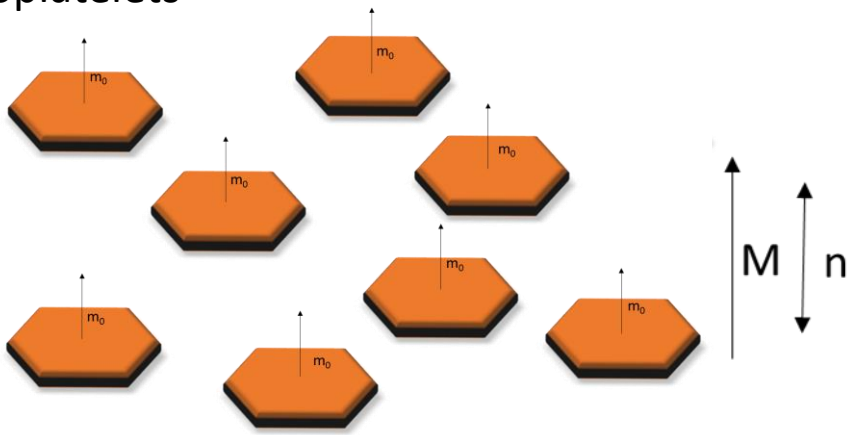
[1] M. Shuai et al., Nat. Commun. 2016, 7, 1–8.

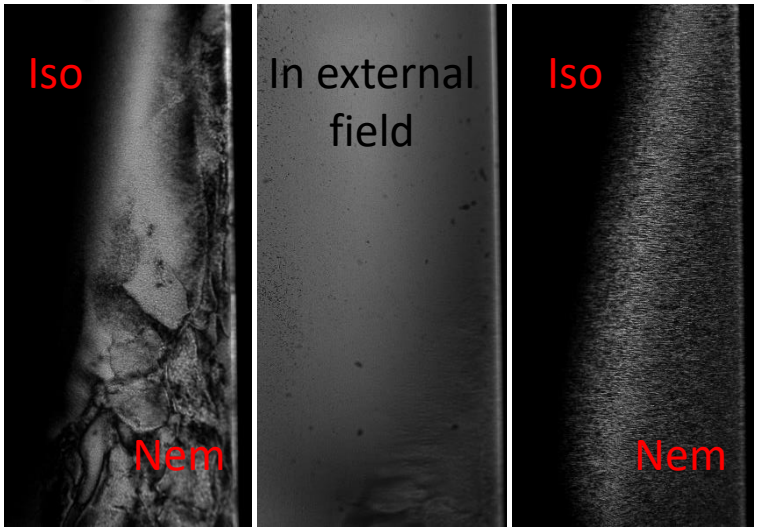
Isotropic and nematic suspension

Isotropic suspension of the nanoplatelets



Ferromagnetic nematic suspension of the nanoplatelets

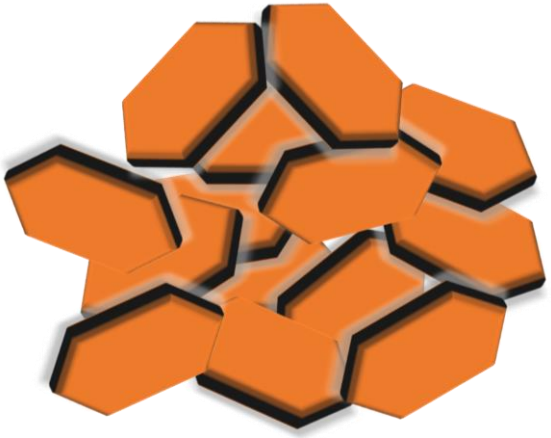




Formation of domains in 1-butanol ferromagnetic nematic suspension.

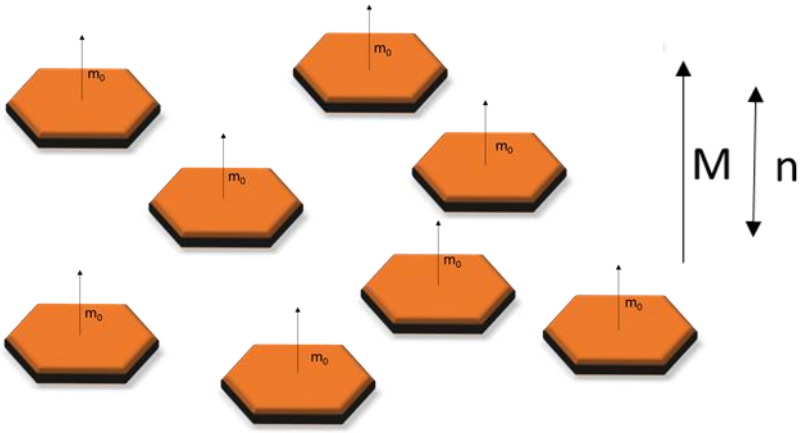
Aggregation vs nematic phase

Aggregation



https://deadline.com/2015/07/minions-crosses-200-million-dollars-record-international-box-office-1201473560/

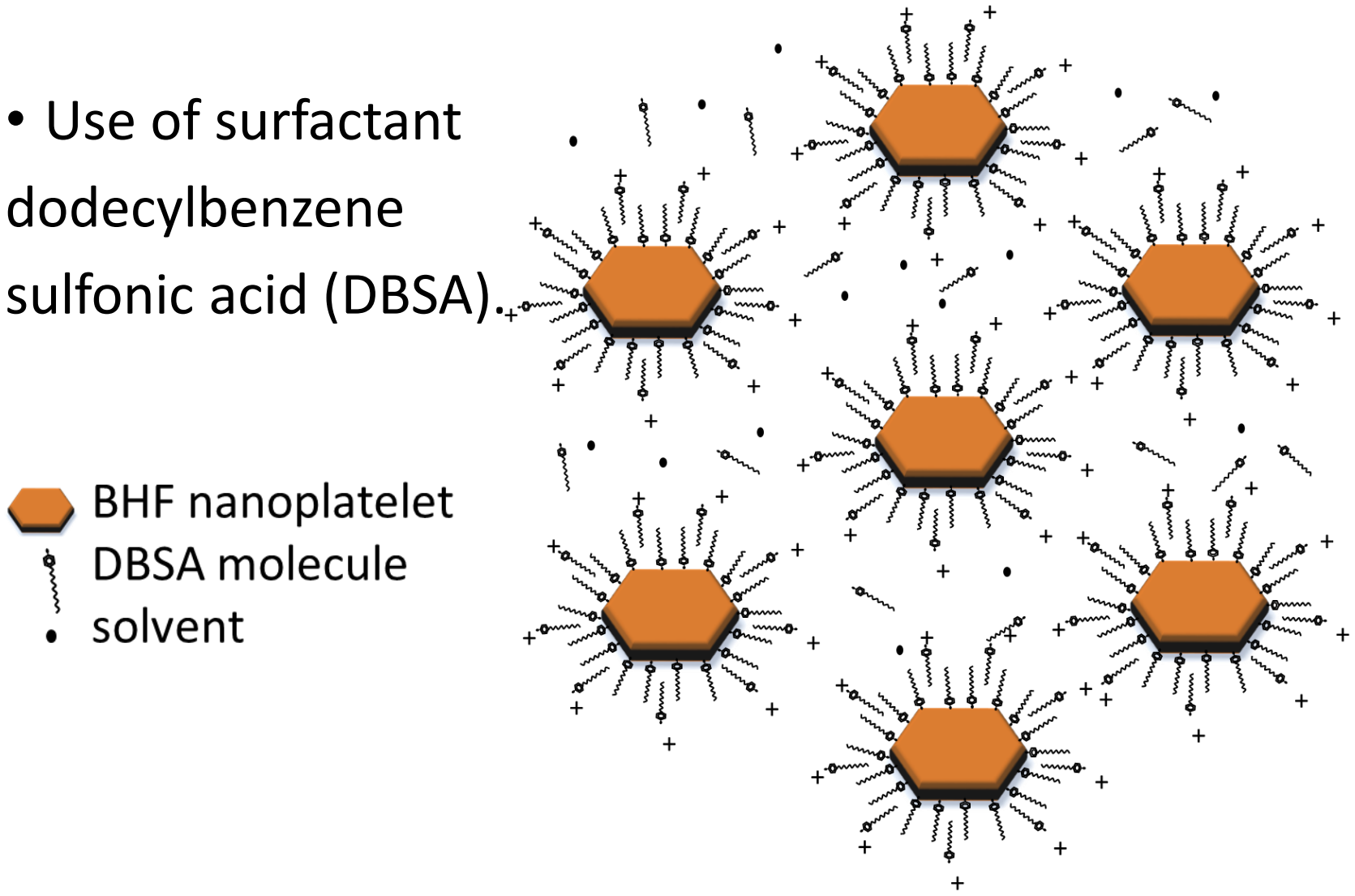
The alignment in the nematic phase



https://giphy.com/gifs/happy-birthday-kJLOin5OUi6uQ

Electrostatic interaction

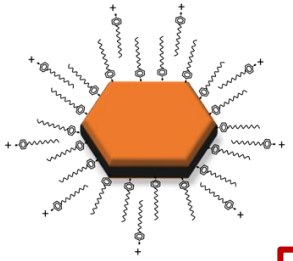
- Use of surfactant dodecylbenzene sulfonic acid (DBSA).



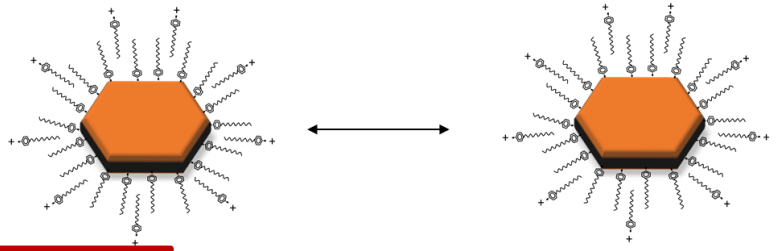
Our work

- Study of parameters that determine electrostatic interaction between the nanoplatelets in t-butanol, 1-hexanol, 1-butanol and 2-propanol.

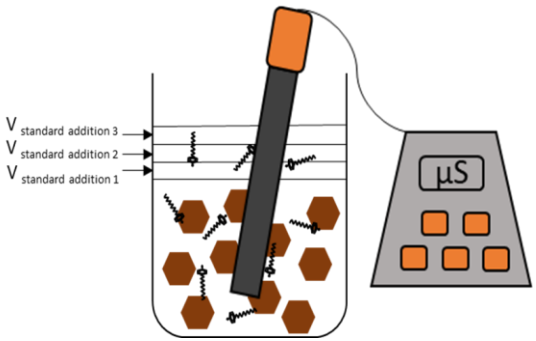
Surface charge

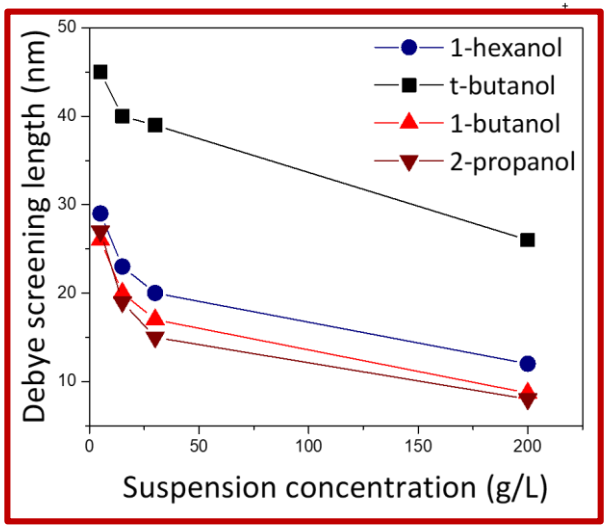


Electrostatic repulsion

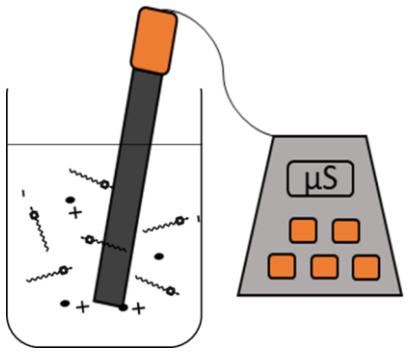


c(DBSA dissolved)





DBSA dissociation degree in alcohols



Debye screening length:
t-butanol > 1-hexanol > 1-butanol > 2-propanol

Thank you for your attention!

Poster no. 10

e-mail: patricija.hribar.bostjancic@ijs.si

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STUDENTS' CONFERENCE

Jožef Stefan International Postgraduate School
and Young Researchers' Day CMBO

15 and 16 April 2019, Planica

Aerosol deposition of $0.9Pb(Mg_{1/3}Nb_{2/3})O_3$-$0.1PbTiO_3$ thick films onto low-cost metal substrates

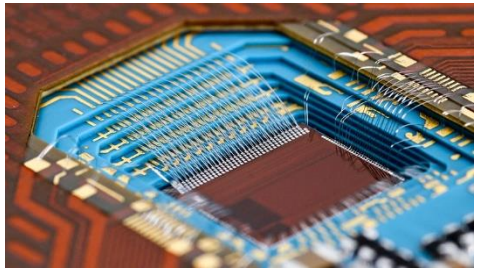
Matej Šadl

Electronic Ceramics Department (K5), Jožef Stefan Institute and
Jožef Stefan International Postgraduate School

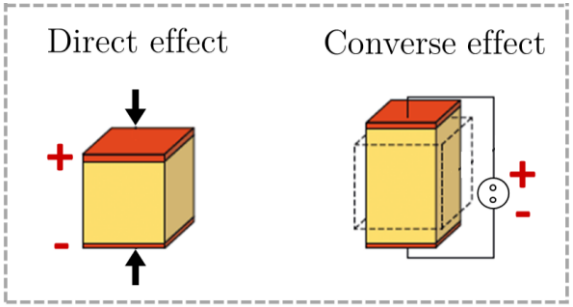
Poster number: 63

Electronic ceramics

…used for their electrical properties



Piezoelectric effect

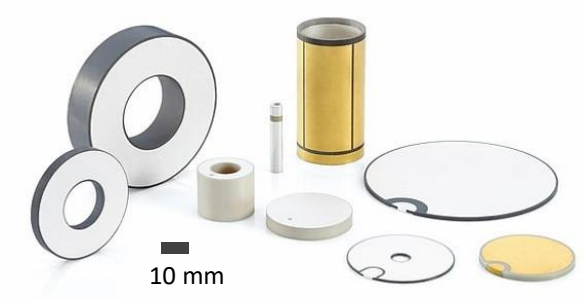


Ink-jet printer

Ultrasound diagnostics

How to miniaturize electronic ceramic components?

Conventional processing of bulk ceramics

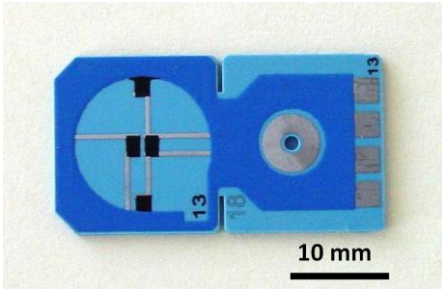


Top-down approach

thickness > 100 µm

Thick film technology

- screen-printing
- electrophoretic deposition
- ink-jet printing

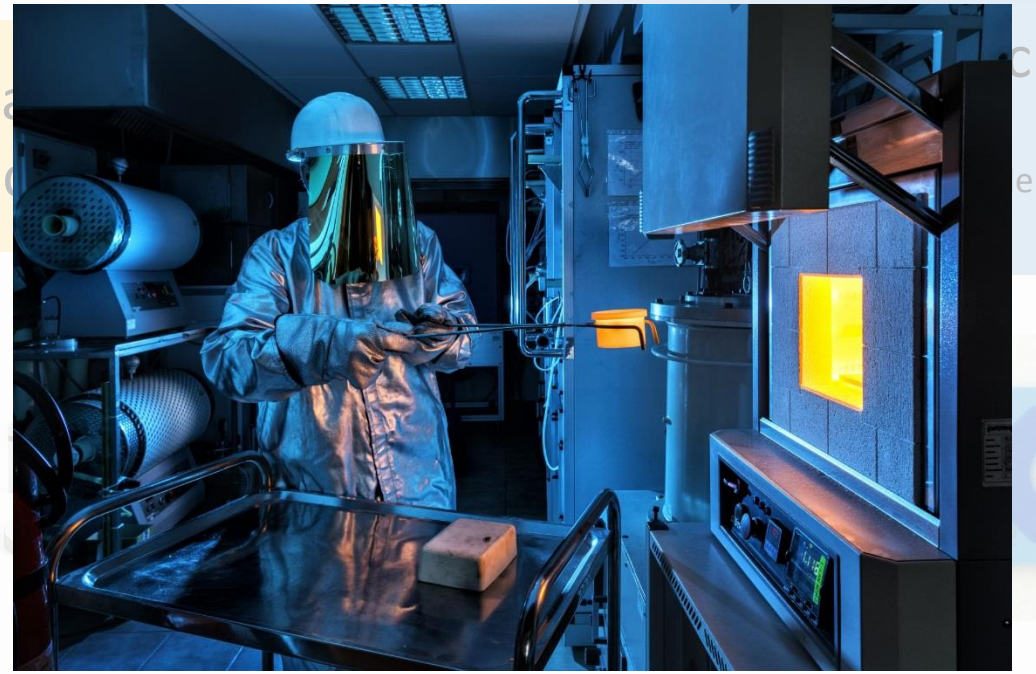


Bottom-up approach

thickness = 1 – 100 µm

How to miniaturize electronic ceramic components?

Conventiona
bulk



chnology
eposition

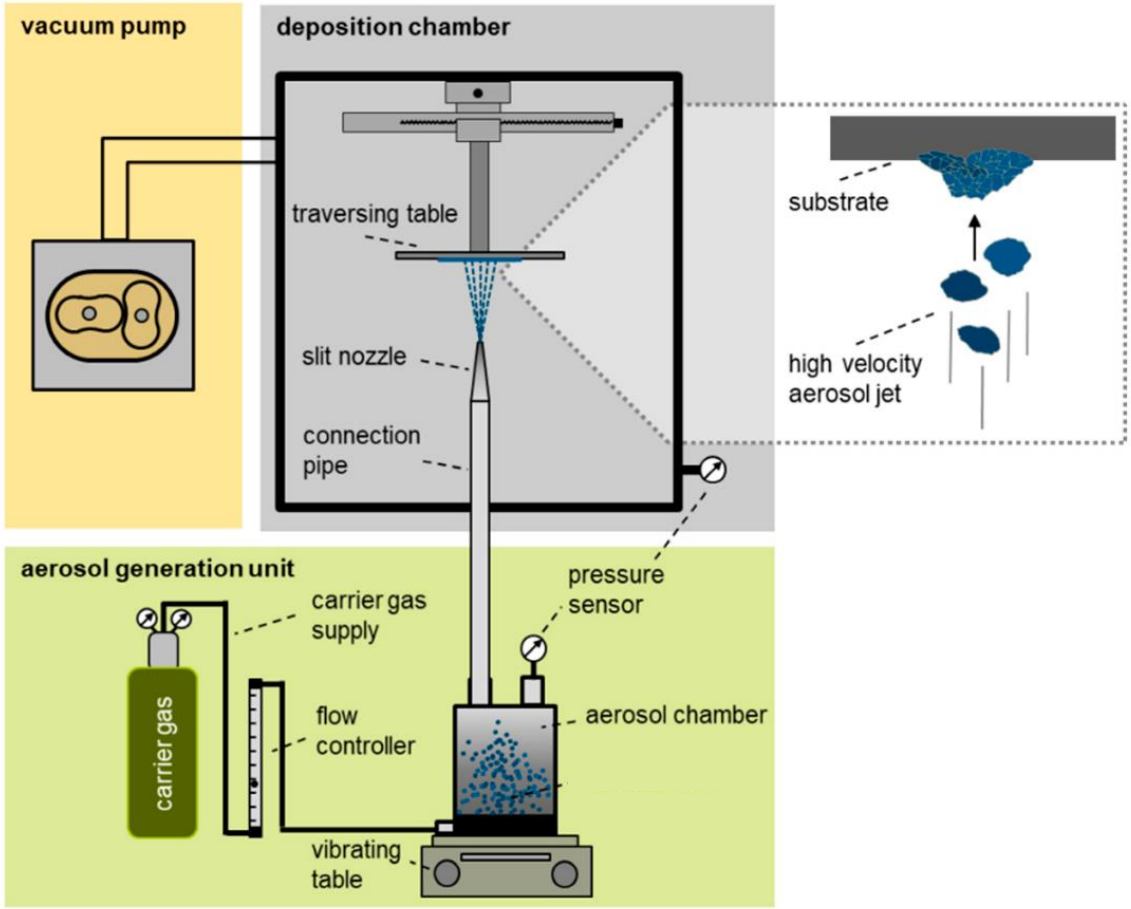
Top-down appro
thickness > 100 µr

high temperature treatment
(~1000 °C)

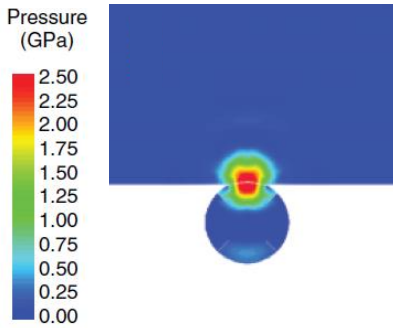
ottom-up approach
thickness = 1 – 100 µm

Aerosol deposition method

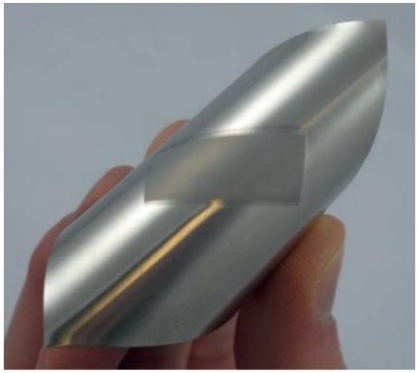
Unique for spray-coating of ceramics



High impact pressures

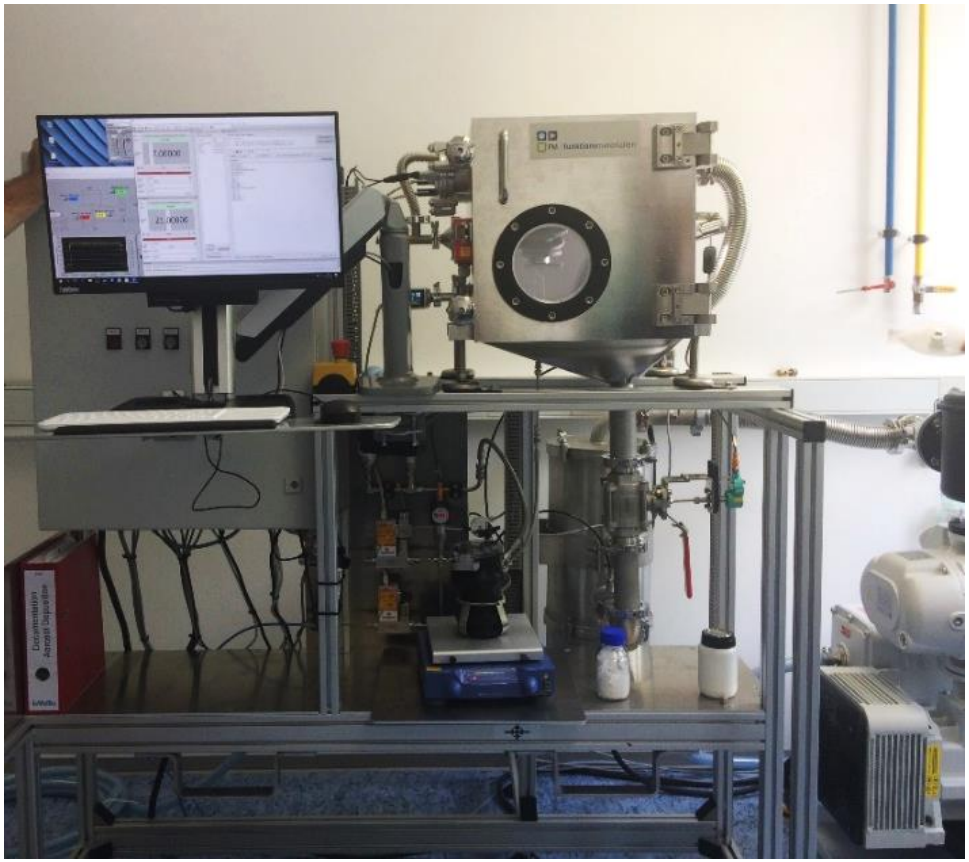


Thick film on a flexible foil

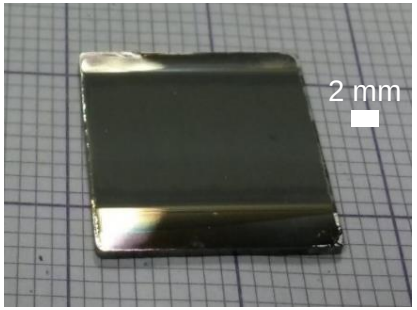


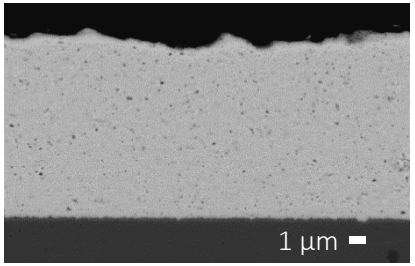
ULTRACOOL lab

Electronic Ceramics Department – K5

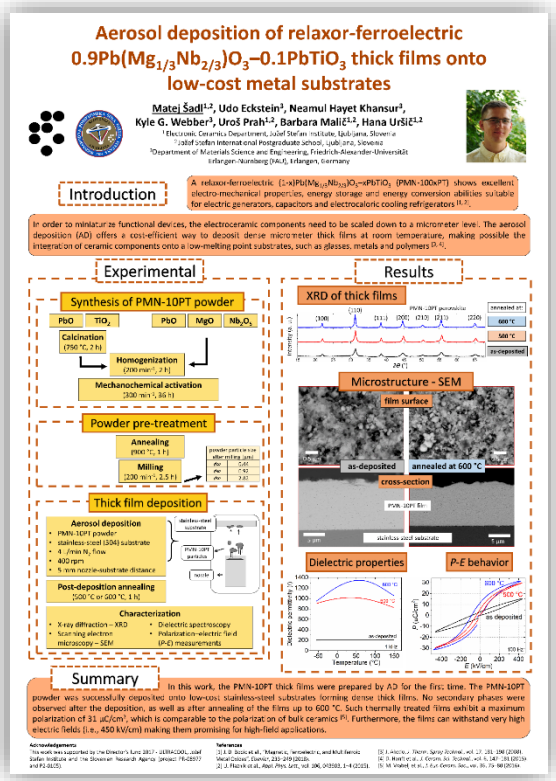


Aerosol deposition of $0.9Pb(Mg_{1/3}Nb_{2/3})O_3–0.1PbTiO_3$ onto stainless-steel substrates





Welcome to poster number 63



Matej Šadl
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Jožef Stefan Institute (JSI)
e-mail: matej.sadl@ijs.si

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15 and 16 April 2019, Planica

Galaxies of gold nanoparticles with plasma

Aswathy Vasudevan,

Department F6, Jozef Stefan Institute

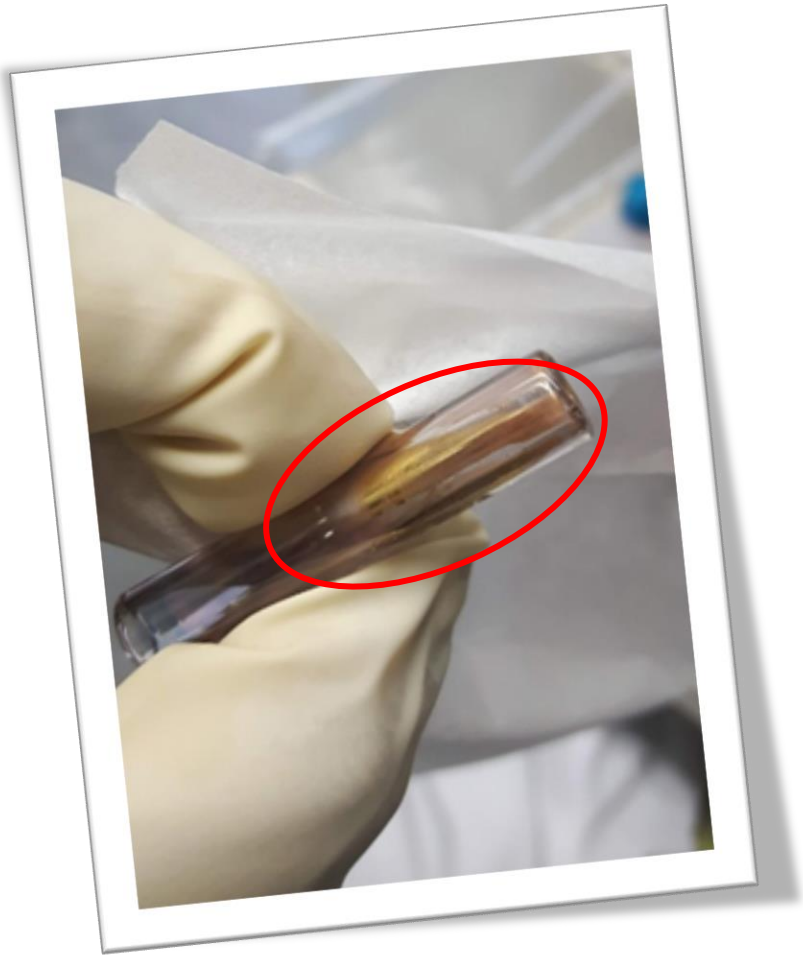
Poster number: 35

Motivation

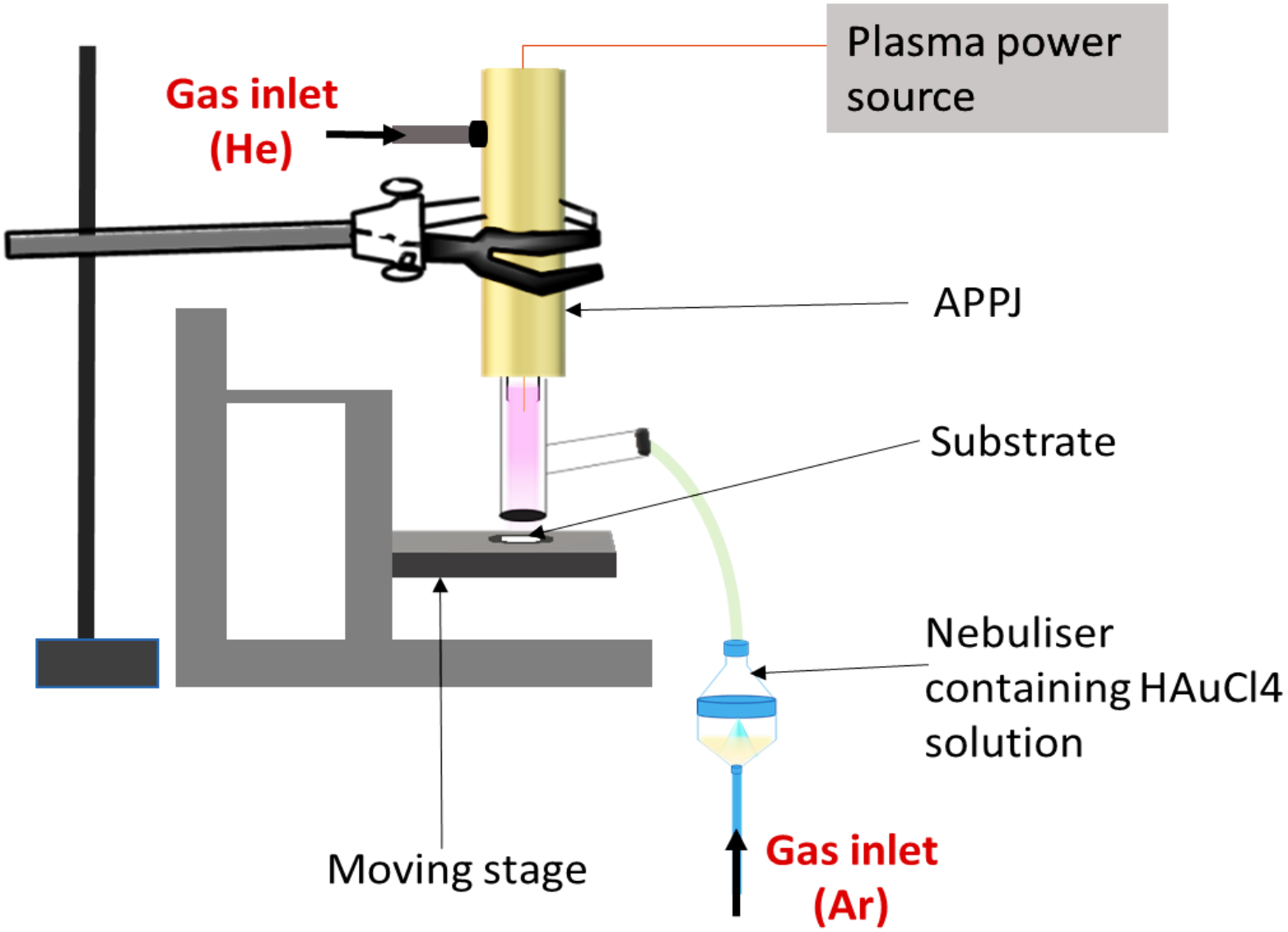
Atmospheric pressure plasma jet (APPJ)

+

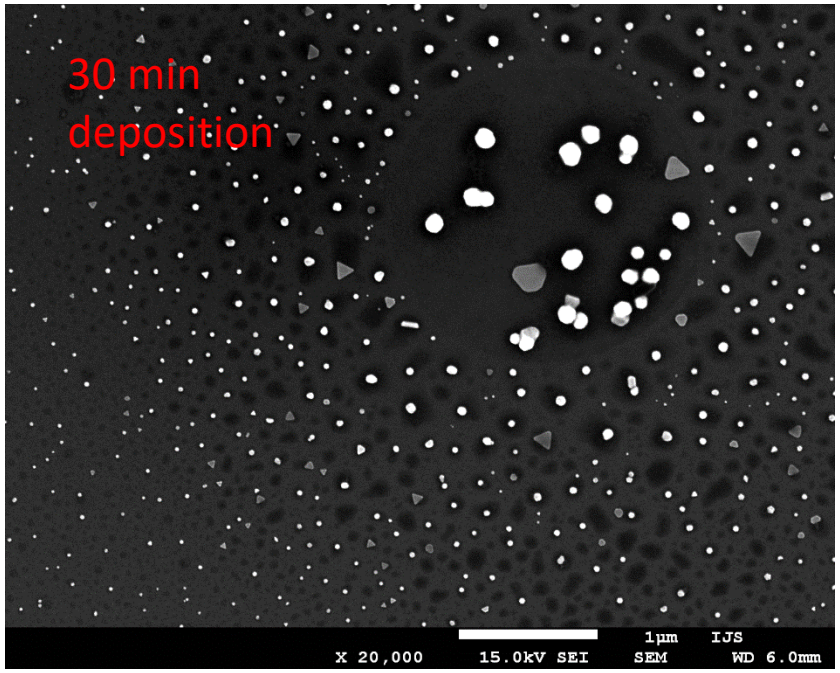
Hydrogen chloroauric acid ($HAuCl_4$)

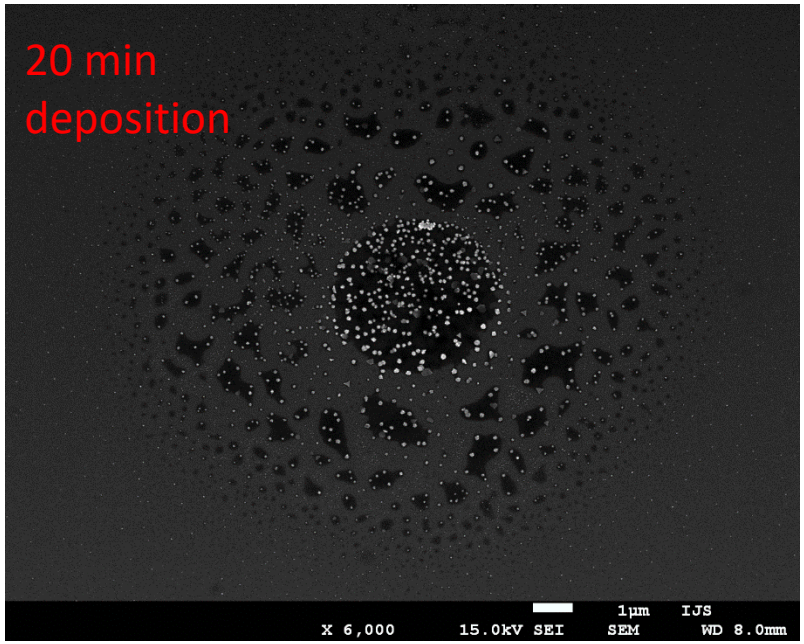


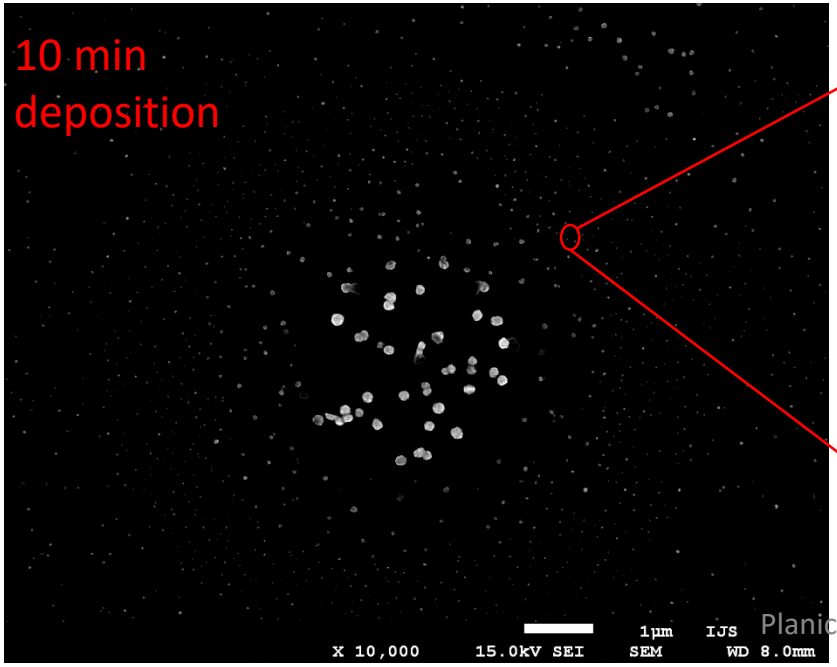
$HAuCl_4$ reduces to Gold in plasma

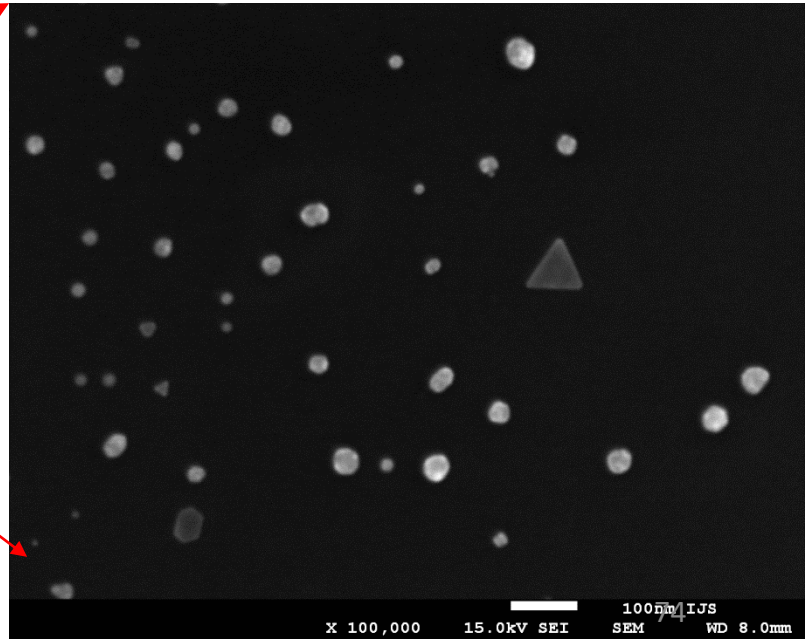

Plasma power source
Gas inlet (He)
APPJ
Substrate
Nebuliser containing HAuCl4 solution
Moving stage
Gas inlet (Ar)

What did I get?









- ✓ Single step
- ✓ No other reagents
- ✓ Reproducible
- ✓ NOT time consuming

Under suitable experiment conditions it deposits gold nanoparticles of size ranging from 5 nm- 100nm

For more information about this works,
Please see poster number: **35**

Thank you for your attention!

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15 and 16 April 2019, Planica

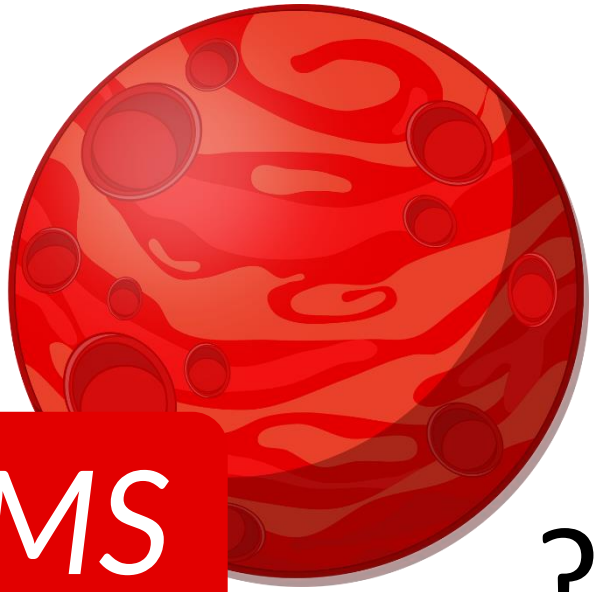
Titanium Metal-Matrix Composites - materials of the future

Martin Topole

Institute of Metals and Technology

International Postgraduate School Jožef Stefan

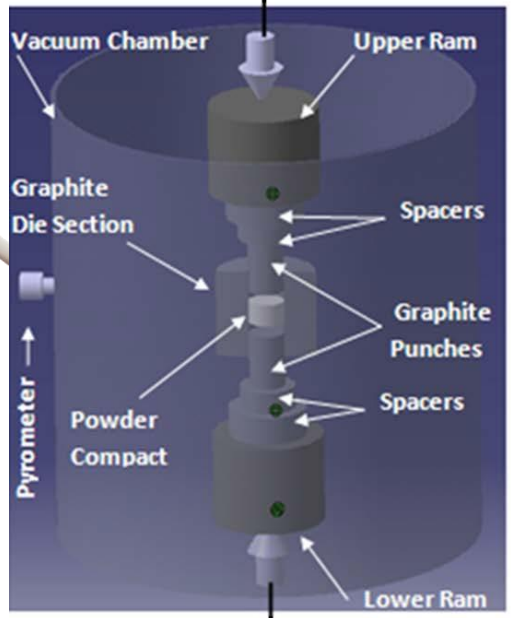
Poster number: 13

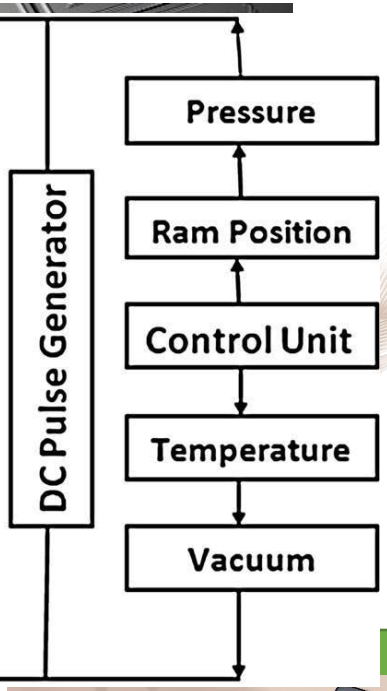


PROBLEMS

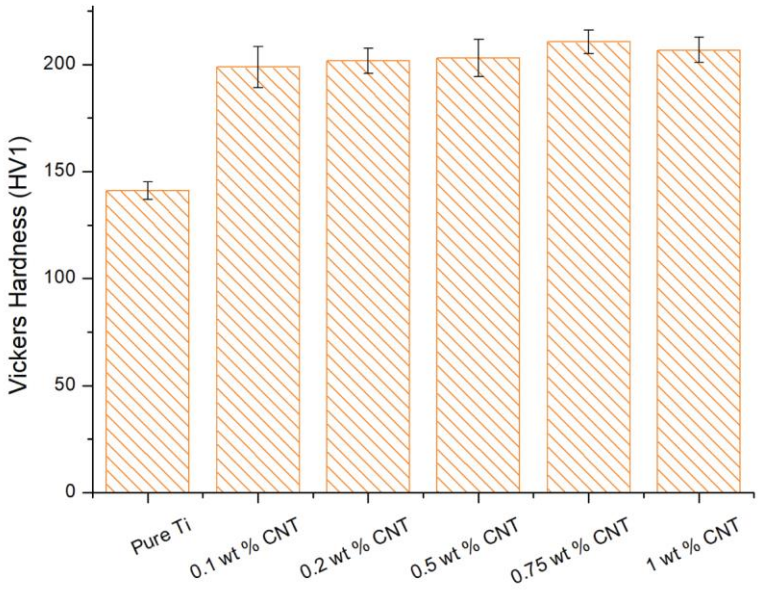
MATERIALS

Field-Assisted Sintering Technique (FAST)





1668 °C!


Vickers Hardness (HV1)
0
50
100
150
200
Pure Ti
0.1 wt % CNT
0.2 wt % CNT
0.5 wt % CNT
0.75 wt % CNT
1 wt % CNT

Acknowledgements

Assoc. prof. Paul McGuiness

Asst. prof. Matjaž Godec

Dr. Darja Jenko

Prof. Mike Reece

Dr. Elinor Gallanis

Dr. Theo Saunders

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15 and 16 April 2019, Planica

A STORY OF CARBON, ALUMINIUM AND FLUORINE BOUND TOGETHER

Evelin Gruden

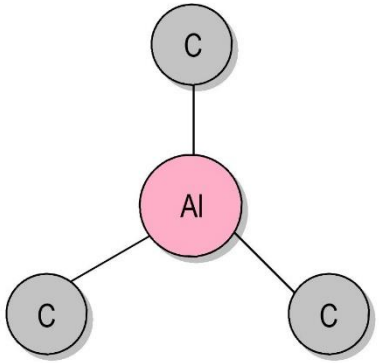
Jožef Stefan" Institute, Department of Inorganic Chemistry and Technology

"Jožef Stefan" International Postgraduate School

Poster number: 22

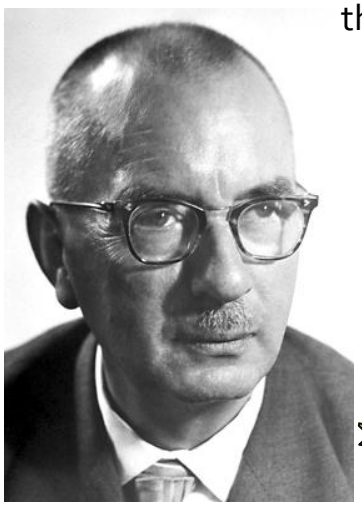
A story of a scientist

Organoaluminium chemistry



Timeline

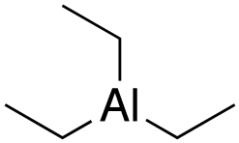
1956 — Development of the new field — 2019

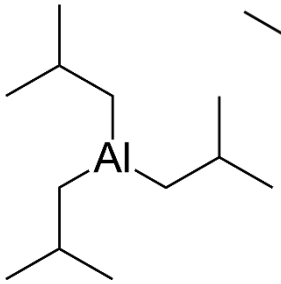


Karl Ziegler

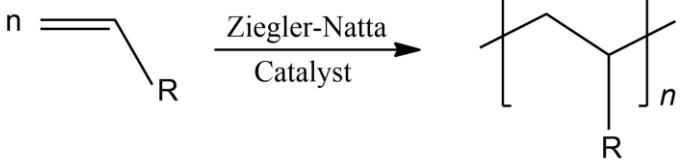
Awarded the Nobel prize in 1963 together with Giulio Natta

Development of the direct synthesis



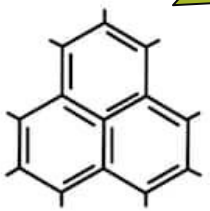


Catalytic olefin polymerization

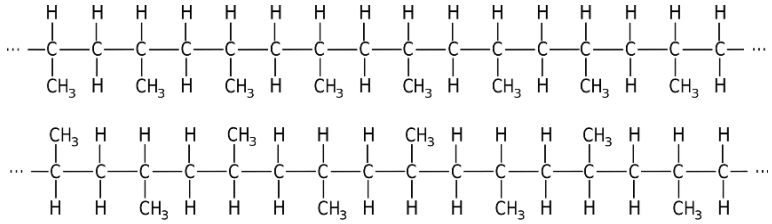


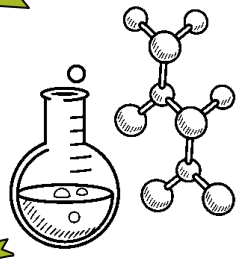
Common plastic

Uses of organoaluminium compounds



ORGANIC SYNTHESIS





INORGANIC MATERIALS

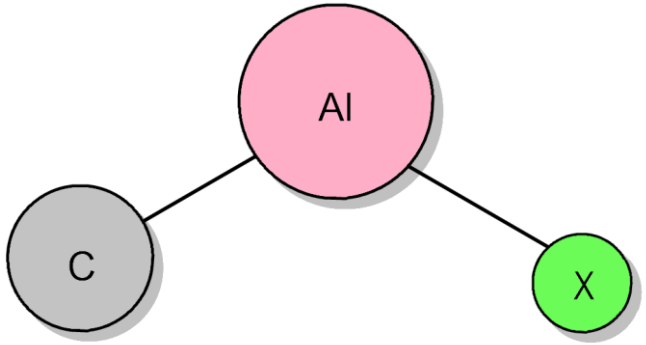
Zeolites

Ceramics

Superconductors

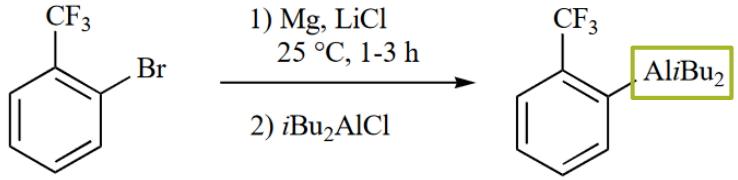
Organoaluminium halides

Compounds containing
C-Al-Cl and **C-Al-Br** bonds are well known.



They are used as:

- Grignard-like reagents

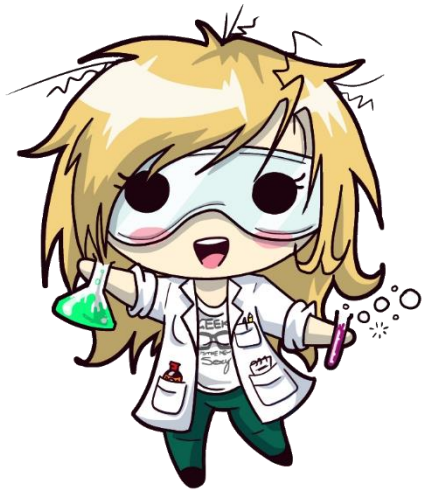


- Ziegler-Natta catalysts

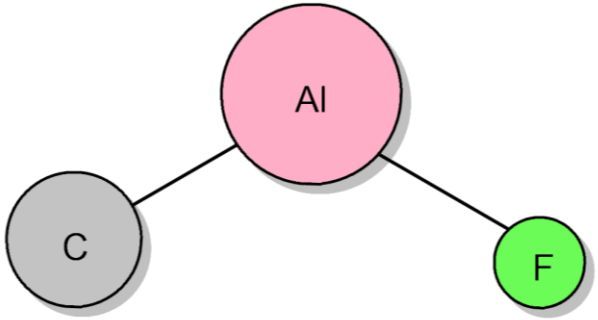
Fluorine?
What about C-Al-F bonds?

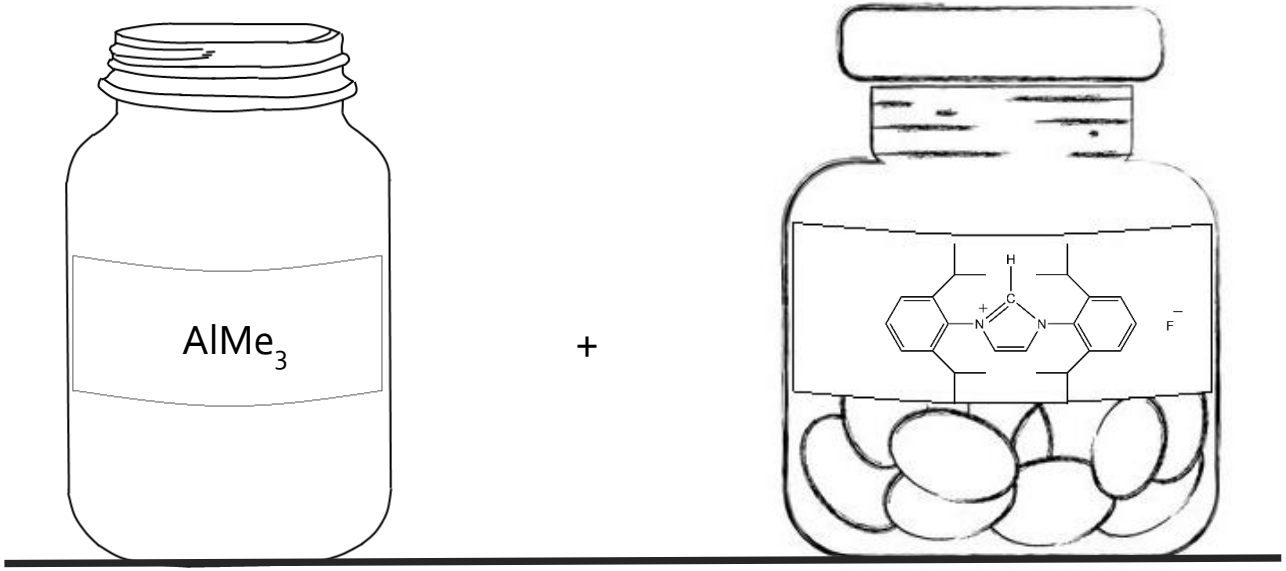
Organoaluminium fluorides are rare.
Could exhibit interesting
chemical properties.

Work of a scientist



Research goal: To introduce **fluorine** into organoaluminium compounds.





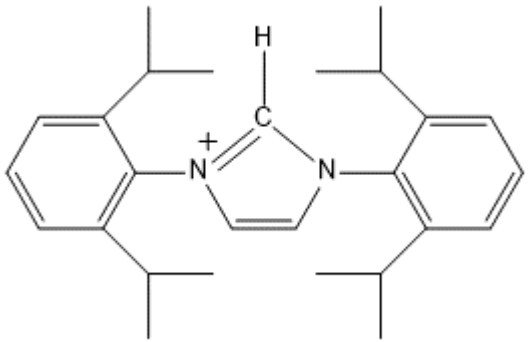
Work of a scientist

Problem: Stability of reactants.
Unstable in the presence of H_2O and O_2.

Glovebox

← Schlenk techniques

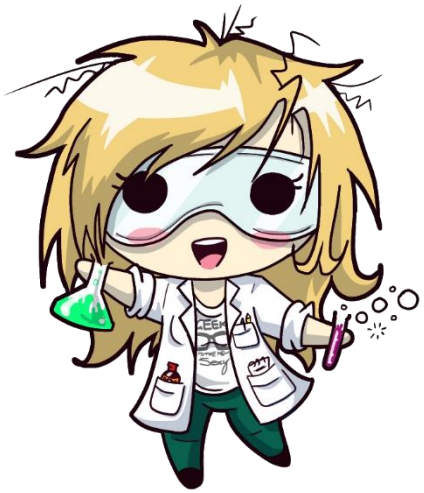
Result



New compound!

[IprH][Me_2AlF_2]

TO BE CONTINUED...



Thank you for your attention!

Evelin Gruden
Department of Inorganic Chemistry and Technology

Poster Number: **22**

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Monday, 15.04.2019

COFFEE BREAK & POSTER SESSION 1

10:50 – 11:15

SUPPORTED BY

Institut "Jožef Stefan" Ljubljana, Slovenija

Mednarodna podiplomska šola Jožefa Stefana Ljubljana Slovenija

IMT

scan

NIB NATIONAL INSTITUTE OF BIOLOGY

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PFEIFFER VACUUM

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KOLEKTOR

PLINDOM

ISO Fd Food ERA Chair Safety Quality Traceability

SRIPTOP

OMNIVAR

B/S/H/

Telekom Slovenije

IPSSC + CMBO

Monday, 15.04.2019

SRIP TOP PRESENTATION

11:15 – 11:30

IPSSC + CMBO

Monday, 15.04.2019

INVITED LECTURE

dr. Kristjan Anderle, Cosylab

11:30 – 12:05

IPSSC + CMBO

Monday, 15.04.2019

LUNCH BREAK

Hotel Dom Planica

12:15 - 13:30

SUPPORTED BY