Prehľad činnosti LMF
2007-2011

Základné údaje

Personálne zloženie

5 vedeckí pracovníci:

P. Diko, K. Zmorayová, M. Šefčiková,
V. Antal (od 07.2010) V. Kavečanský (od 2011)

3 PhD študenti:

FTL: D. Volochová, S. Piovarči
Materiály: M. Kalmanová

1 vedecko-technický pracovník

P. Kulík

Vedecký program

Masívne monokryštalické REBCO supravodiče

IOP Publishing
Superconductor Science and Technology
Supercond. Sci. Technol. **21** (2008) 115008 (3pp)
doi:10.1088/0953-2048/21/11/115008

Elimination of oxygenation cracks in top-seeded melt-growth YBCO superconductors by high pressure oxygenation

P Diko[1], X Chaud[2], V Antal[1], M Kaňuchová[1], M Šefčíková[1] and J Kováč[1]

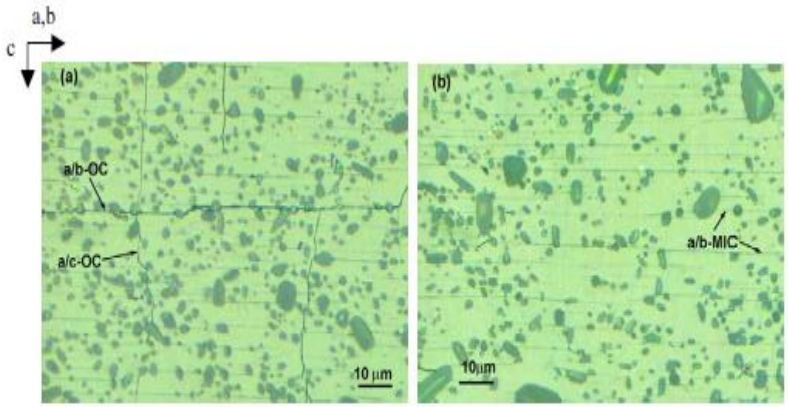


Figure 1. Micrographs taken from the sample sections. (a) Traces of the oxygenation cracks parallel to the *a*/*c*-plane (*a*/*c*-OC) and *a*/*b*-plane (*a*/*b*-OC) in the sample after standard oxygenation at 400 °C and oxygen flow. (b) Oxygenation cracks are not present in the sample oxygenated at 750 °C with progressive oxygen pressure increase to 16 MPa. Only the traces of microcracks parallel to the *a*/*b*-plane (*a*/*b*-MIC) generated by Y211 particles can be seen.

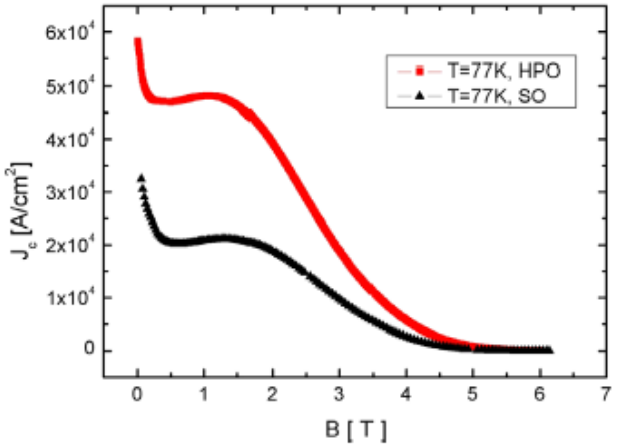


Figure 2. Dependence of critical current density, J_c, on magnetic field. Higher critical current density for the sample oxygenated at 750 °C with progressive oxygen pressure increase to 16 MPa (HPO) and in the sample oxygenated in oxygen flow at 400 °C (SO).

IOP Publishing — Superconductor Science and Technology
Supercond. Sci. Technol. **22** (2009) 105001 (7pp) doi:10.1088/0953-2048/22/10/105001

Flux pinning in Al doped TSMG YBCO bulk superconductors

V Antal[1,2], M Kaňuchová[1], M Šefčiková[1], J Kováč[1], P Diko[1], M Eisterer[2], N Hörhager[2], M Zehetmayer[2], H W Weber[2] and X Chaud[3]

[1] Materials Physics Laboratory, Institute of Experimental Physics, Slovak Academy of Sciences, Watsonova 47, 04001 Košice, Slovakia
[2] Vienna University of Technology, Atominstitut, Stadionallee 2, 1020 Vienna, Austria
[3] CNRS/CRETA, 25, Avenue des Martyrs, 38042 Grenoble Cedex 9, France

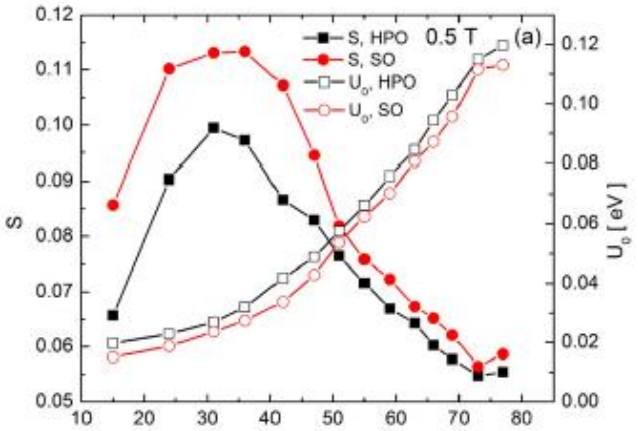


Figure 7. Temperature dependence of the normalized relaxation rates (full symbols), S, and the apparent pinning energy (open symbols), U_0, for $YBa_2(Cu_{1-x}Al_x)_3O_7$ with $x = 0.0025$ for SO and HPO in applied magnetic fields parallel to the c-axis at 0.5 T (a) and 1 T (b).

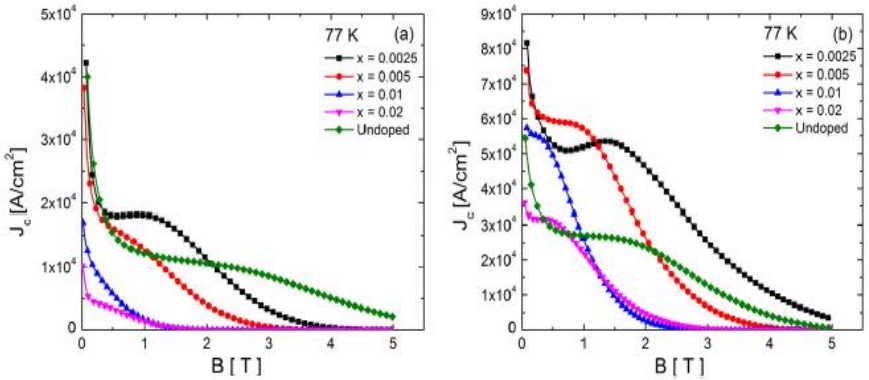


Figure 1. Dependence of critical current densities, J_c, on magnetic field, B, for $YBa_2(Cu_{1-x}Al_x)_3O_7$ after standard oxygenation (SO) (a) and after high pressure oxygenation (HPO) (b).

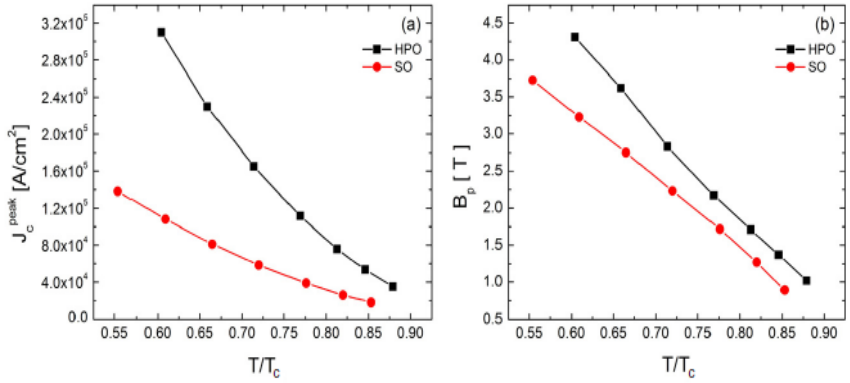


Figure 3. Comparison of the temperature dependence of J_c peak (a) and peak fields, B_p, (b) for $YBa_2(Cu_{1-x}Al_x)_3O_7$ at the lowest concentration of Al $x = 0.0025$ between SO and HPO.

Materials Science and Engineering B 151 (2008) 107–110

Influence of crystal plane on the welding quality of YBCO bulk superconductor

M. Šefčiková[a], P. Diko[a,*], B. Bozzo[b], X. Granados[b], X. Obradors[b]

[a] *Institute of Experimental Physics, Slovak Academy of Sciences, Watsonova 47, 04001 Košice, Slovakia*
[b] *Institut de Ciència de Materials de Barcelona, CSIC Campus, UAB 08193 Bellaterra, Spain*

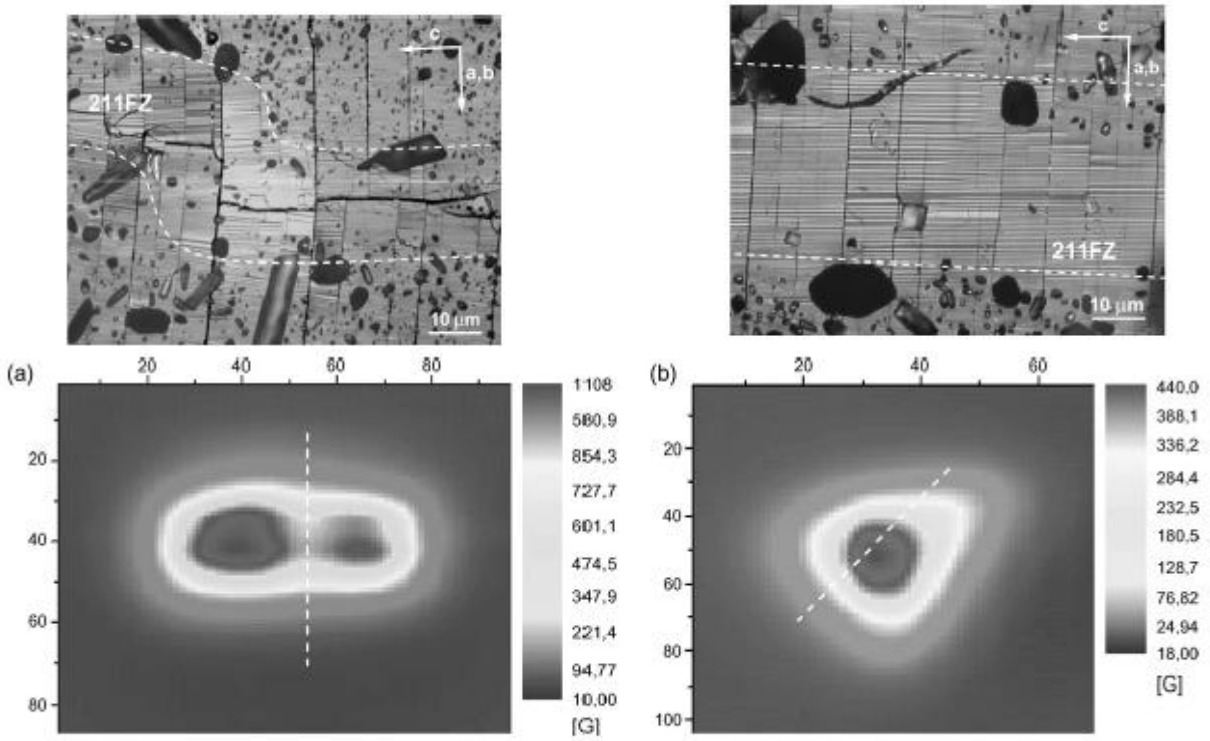


Fig. 3. The trapped field maps obtained from Hall probe imaging for {1 0 0} weld (a) and for {1 1 0} weld (b). The welds are marked by white line.

Physica C 470 (2010) 155–158

Behavior of silver substitution in single-grain TSMG YBCO bulk superconductor

P. Diko [a,*], V. Antal [a], M. Kaňuchová [a], M. Jirsa [b], K. Jurek [b]

[a] Institute of Experimental Physics SAS, Watsonova 47, 04001 Košice, Slovak Republic
[b] Institute of Physics ASCR, Na Slovance 2, CZ-182 21 Prague 8, Czech Republic

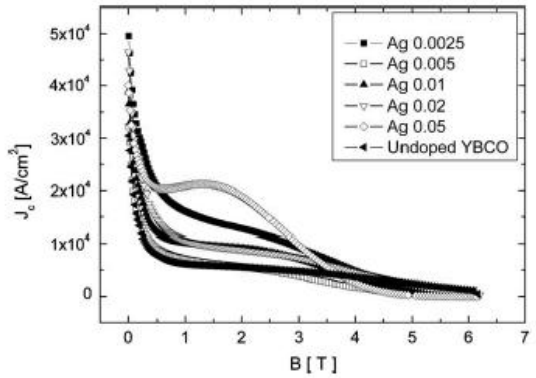


Fig. 3. Dependences of critical current densities, J_c, on applied magnetic field, B, at 77 K. Peak effect appears in $Y_1Ba_2(Cu_{1-x}Ag_x)_3O_7$ bulk superconductor with the highest nominal Ag concentration for $x = 0.05$.

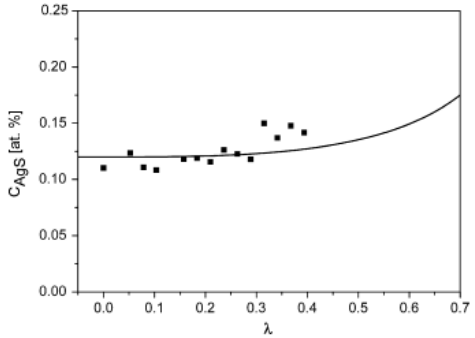


Fig. 2. The dependence of measured (black squares) Ag concentration, C_{Ag}, in the solid Y123 matrix on the relative distance from the seed, λ. The solid curve represents the model given by Eq. (1). The standard deviation, σ, of WDS measurement is 0.02 at.%.

$$C_{AgS(a)} = k_{Ag} C_{Ag0} \{1 - \lambda^3\} k_{Ag} - 1$$

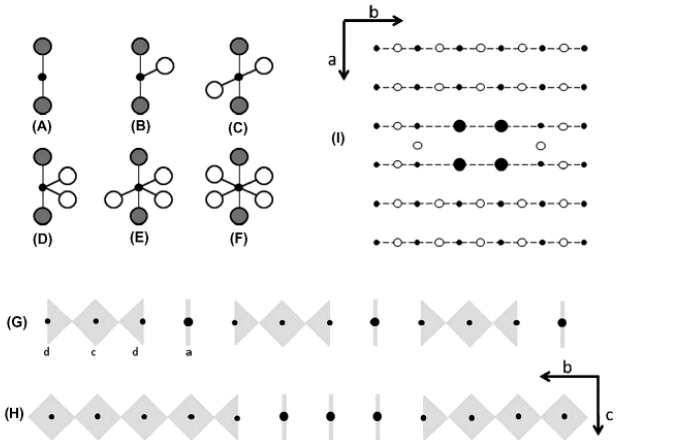


Fig. 4. (a–f) Various oxygen configurations about the metal atom in the chains of CuO plane. The solid circle indicates the metal atom. Open and filled circles indicate in-plane and out-of-plane oxygen atoms, respectively. (g–i) The concentration of (d) configurations is lower when linear (h) or two dimensional (i) Ag clusters are formed. The smaller solid circles represent the Cu atoms and the larger ones represent the Ag atoms.

JOURNAL OF APPLIED PHYSICS 105, 063503 (2009)

Influence of 211 particles on twin spacing in top-seeded melt-growth YBCO bulk superconductors

P. Diko[a] and D. Šuster
Institute of Experimental Physics, Slovak Academy of Sciences, Watsonova 47, 04001 Košice, Slovakia

$$\lambda_{TS} = (\gamma_{tw} \mathrm{MFD}_{211} / \alpha \mu \varepsilon^2)^{1/2}.$$

$$\mathrm{MFD}_{211} = (1 - V_{211})/N_{211}.$$

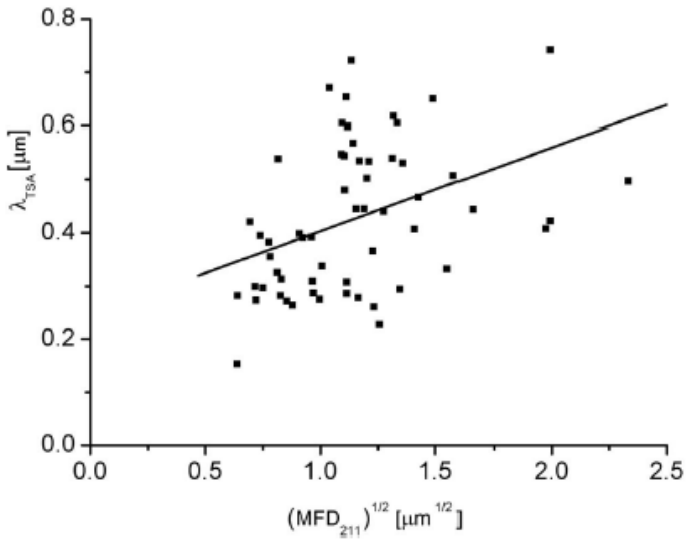


FIG. 7. Linear fit of the apparent twin spacing λ_{TSA} on the square root of the mean free distance between Y211 particles MFD_{211}.

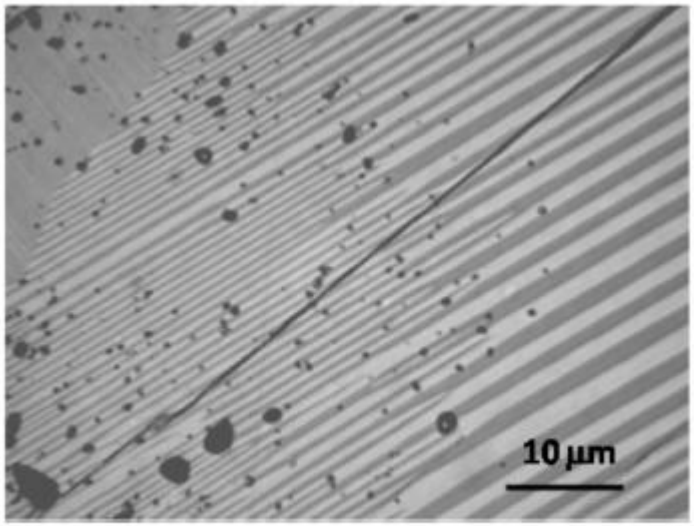


FIG. 6. Twin splitting caused by presence of Y211 particles.

1. **Vedecké výstupy**

	Časopis	Impact factor	Počet publikácií
1	Supercond. Sci. Technol.	2.4	5
2	J. Appl. Phys.	2.1	1
3	Mat. Sci. Engn. B	1.6	3
4	Physica C	1.4	3
5	J. Cryst. Growth	1.74	1
6	J. Low. Temp. Phys.	1.4	1
7	IEEE Tr. Appl. Sup.	1.3	2
8	Cent. Eu. Chem. J.	0.99	1
9	Acta Phys. Pol.	0.6	4
10	Int. J. Mat. Prod. Tech.	0.38	2
11	Key. Eng. Mat	0.22	1
		Priemer 1.28	Spolu 23

Scientometrický sumár

A = Počet CC prác = 23 za 5 rokov

B = Počet tvorivých prac. (aj doktorandi) = cca 4.8

X = A/B =4.8; X/5= 0.96 /TP/rok

2. Ohlasy na vedecké výstupy

Počty citácií WOK, SCOPUS 2007-2011(cca 150, asi 10 cit./TP (3)/rok)
2007 – 21, 2008 – 36, 2009 – 21, 2010 – 42, 2011 – 28

Zoznam najcitovanejších prác a počet ich ohlasov za 2007-2011

P. Diko, G. Fuchs, G. Krabbes, Influence of silver addition on cracking in melt-grown YBCO, Physica C 363 (2001) Nr. 1, S. 60-66 , Citácie 2007-11: 10

P. Diko, G. Krabbes, Macro-cracking in melt-grown YBaCuO superconductor induced by surface oxygenation, Supercond. Sci. Technol. 16 No 1 (January 2003) 90-93 . Citácie 2007-11: 10

P. Diko, Cracking in melt-grown RE-Ba-Cu-O single-grain bulk superconductors, Topical Reviev in Supercond. Sci. Technol. 17 (2004) R45-R58. Citácie 2007-11: 9

P. Diko, Growth-Related Microstructure of Melt-Grown REBa2Cu3Oy Bulk Superconductors, Supercond. Sci. Technol. Vol. 13, No. 8., 2000, 1202-1213. Citácie 2007-11: 8

P. Diko, Cracking in Melt-Processed RE-Ba-Cu-O Superconductors, Supercond. Sci. Technol. 11 (1998) 68-72 Citácie 2007-11: 8

Zoznam najviac citovaných autorov z organizácie a počet ich ohlasov za hodnotené obdobie
P. Diko, 145

3. Vedecké postavenie

Zoznam pozvaných prednášok na medzinárodných konferenciách

P. Diko, M. Kaňuchová, M. Šefčíková, K. Zmorayová, PASREG, 2007, Cambridge, England, 13 – 15 September 2007,

X. Chaud, T. Prikhna, Y. Savchuk, A. Joulain, E. Haanappel, P. Diko, L. Porcar, M. Soliman, PASREG, 2007, Cambridge, England, 13 – 15 September 2007,

DIKO, Pavel - ZMORAYOVÁ, Katarína - ŠEFČÍKOVÁ, Martina - ANTAL, Vitaliy - KAVEČANSKÝ, Viktor - CHAUD, Xavier - EISTERER, M. - WEBER, H. PASREG 2010 July 29-31, 2010, Washington.

DIKO, Pavel. ICSM 2010 25-30 April 2010, Antalya, Turkey.

P. Diko, člen Editorial Board ISRN Condensed Matter Physics

Členstvo v komisiách medzinárodných konferencií

P. Diko, International Advisory Committee, PASREG 29–31 July 2010 , Washington DC, USA.
P. Diko, Internationa Scientific Commitee, METALLOGRAPHY ’07, 02- 04.06.2007, Stará Lesná, Slovakia.
P. Diko, International Advisory Board, NANOVED 2007, Bratislava, Slovakia, November 11 – 14, 2007

Vedenie sekcií na medzinárodných konferenciách

P. Diko, 9th EUCAS, September 13-17, 2009 Dresden, Germany
P. Diko, METALLOGRAPHY ’07, Stará Lesná, Slovak Republic.
P. Diko, PASREG, 2007, Cambridge, England, 13 – 15 September 2007.
P. Diko, International Conference Fractography of Advanced Ceramics, 2008 Stará Lesná, Slovakia.

Recenzie významných časopisov : 1. J. Appl. Phys. , 2. Supercond. Sci. Technology , 3. Physica C, 4. J. Crystal Growth, 5. Crystal Growth and Technology , 6. Journal of Alloys and Compounds , 7. Journal of Materials Research, 8. Journal of Materials Science, 9. The Journal of Physical Chemistry , 10. Recent Patents on Materials Science, 11. Materials Chemistry and Physics, 12. Materials Science and Engineering B, 13. physica status solidi , 14. Journal of the European Ceramic Society, 15. IOP Journal of Physics: Conference Series .

Recenzie projektov a prác: zahraničné, APVV, VEGA, ASFEU, PhD, DrSc, Doc. atd.

4. Projekty

Medzinárodné RP

NESPA., NanoEngineered Superconductors for Power Aplications 6-th Framework Program, Marie Currie Training Network, 2006/2010, **Ukončený 30.9.2010. 130 k€ pre LMF**

EFFORT , The European Forum for Processors of Large Grain (RE)BCO, P. Diko, 2001-2007 **20 k€**

ESO Engineering in Superconductivity, ***ERANET MVTS*** (ÚEF SAV, OFNT, LMF, FzÚ AVČR) 2010-2012, P. Samuely

Medzinárodné dvojstranné

Slovak and Spanish Gov. Pr. No. 2009SK0005, Chemical nanosize pinning centers in YBCO superconductors, (ÚEF SAV a ICMAB-CSIC Barcelona) **2010 – 2011, 3 k€**

Slovak and France Gov., Pr. No. Stefanik 23, Cracking during oxygenation of YBCO bulk, (ÚEF SAV and CRETA-CNRS Grenoble), P. Diko, 2006-2007, **5,5 k€ Sk.**

Domáce

APVV, Dizajn mikroštruktúry YBCO masívnych supravodičov 2006/2009. **120 k€**

APVV LPP, Monokryštalické kompozitné YBCO supravodiče 2006/2009. **85 k€**

VEGA 2/7052/27, YBCO supravodiče pre silnoprúdové aplikácie, 2007/2009. **15k€**

VEGA 2/0211/10, Nanoštruktúrované komplexné oxidy s perovskitovou štruktúrou, 2010 – 2012, **20 k€**

Centrá excelentnosti SAV

NANOSMART, Centrum nanoštruktúrovaných materiálov, 2007/2010. **20 k€ pre LMF**

Centrum fyziky nízkych teplôt a materiálového výskumu v extrémnych podmienkach. 2011/2014, P. Samuely

Projekty štrukturálnych fondov

MS2G Výskum a vývoj masívnych YBCO supravodičov druhej generácie
Obdobie: 11.2009 – 10.2012
Zodpovedný riešiteľ: P. Diko, projektový manažér, K. Zmorayová
Riešitelia: LMF + J. Kováč, **280 k€**

NMTE Nové materiály a technológie pre energetiku
Obdobie: 5. 2010 – 4. 2013
Koordinátor projektu: P. Diko, projektový manažér: M. Šefčiková
M. Antalík OBF, I. Škorvánk LNAM, F. Kováč ÚMV, P. Kopčanský OTF a M. Timko OFMJ.
3000 k€

CEX I, CEX II Centrum excelentnosti progresívnych materiálov s nano a submikrónovou štruktúrou
Koordinátor projektu: J. Dusza ÚMV, asistent PM pre ÚEF SAV: M. Šefčiková
Obdobie: 2009-2012
Oddelenie: Nanoštruktúrované supravodiče (P. Diko, LMF) **600 k€**

Podiel na projektoch 5.1 (THS, UEF), 2.1 (M. Zentková) a Edukačné centrum pre výskum a vývoj komplexných nanosystémov (P. Kopčanský)

Nová infraštruktúra zabezpečovaná LMF v hodnote 2000 k€ (22 prístrojov a zariadení)

5. Doktorandské štúdium

FTL: Katarína Zmorayová, Martina Šefčiková**,** Vitalij Antal, Daniela Volochová, Samuel Piovarči,

Dušan Šuster, Radovan Brenkus

Materiály: Monika Kalmanová

Obhajoby PhD prác : Katarína Zmorayová 2007, Martina Šefčiková 2007, Vitalij Antal 2010

7. Popularizácia

Deň otvorených dverí
Fyzika na ulici

8. Infraštruktúra a personálny rozvoj

Laboratórium keramických technológií

Laboratórium keramických technológií

Vákuová rúrová pec

Vysokotlaká pec

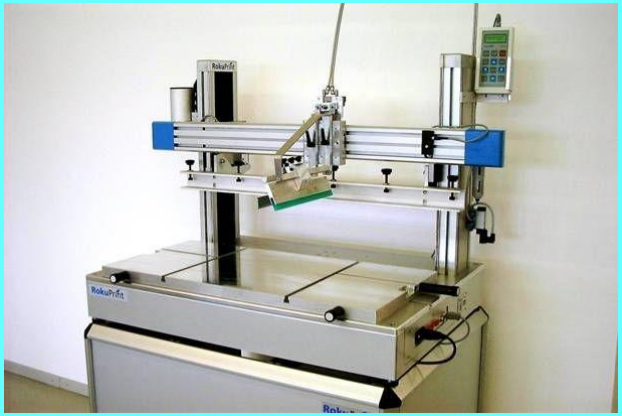
Komorová pec
s všestranným ohrevom

Laboratórium keramických technológií

Atritor

Odparovačka

Sieťotlač
na hrubé vrstvy



Indukčný ohrev

Laboratórium röntgenovej a termickej analýzy

Laboratórium röntgenovej a termickej analýzy

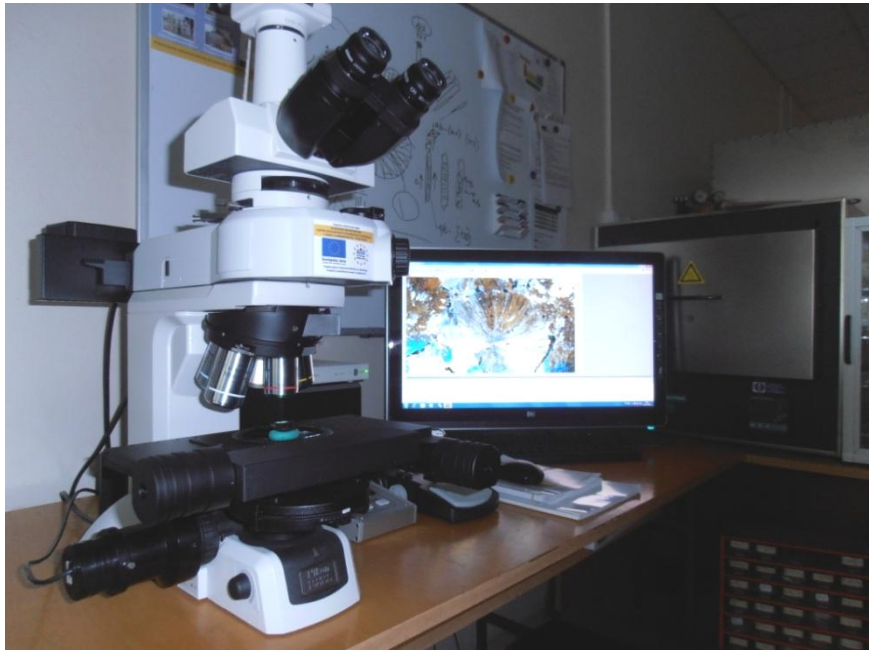
Termický analyzátor

Analytická váha

RTG difraktometre

Laboratórium fyzikálnych meraní a mikroštruktúry

Svetelná mikroskopia a príprava preparátov



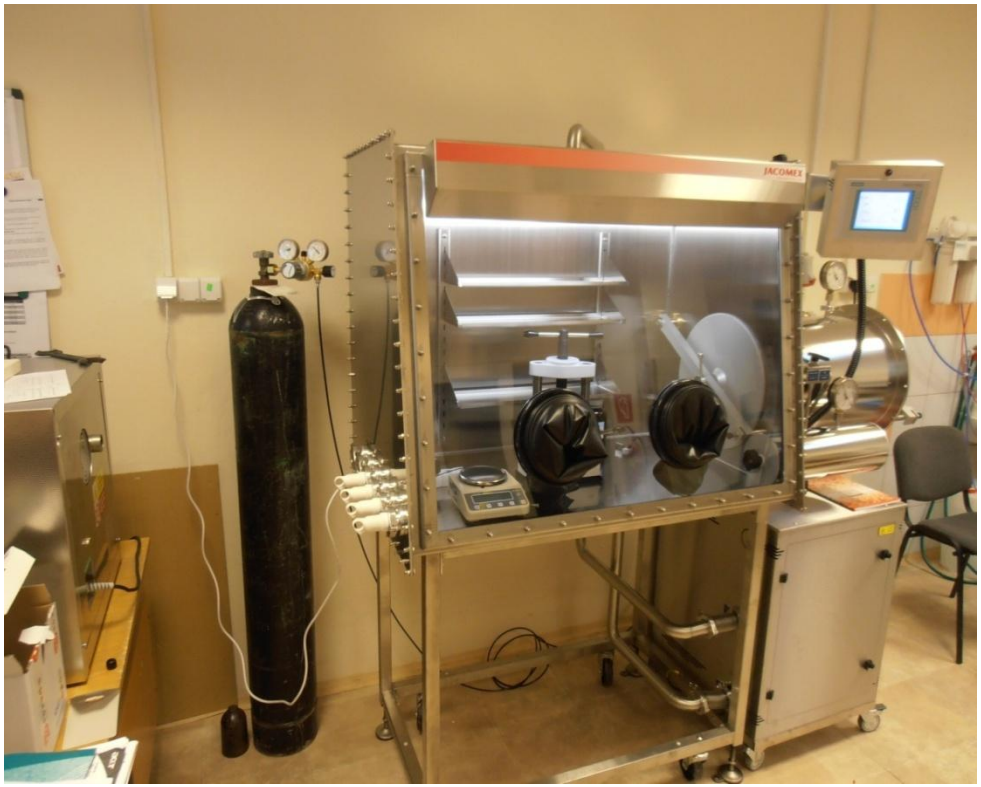
Presná kotúčová rezačka

Polarizačný mikroskop

Zalisovanie vzoriek

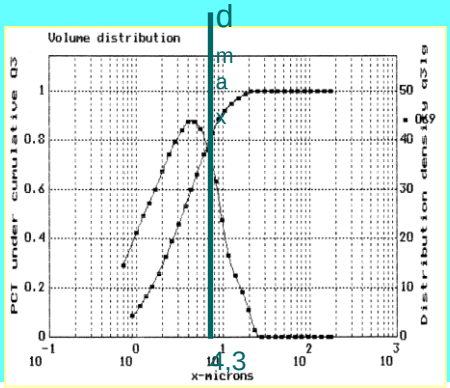
Ultrazvuková rezačka

Laboratórium fyzikálnych meraní a mikroštruktúry



GlovBox

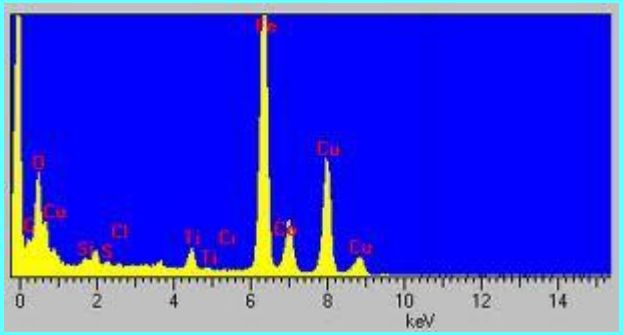
Granulometer



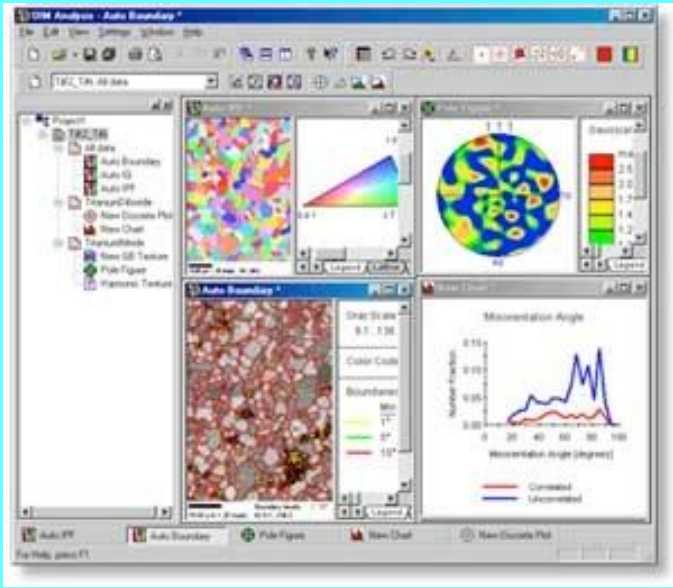
Laboratórium eletrónovej mikroskopie a mikroanalýzy

SEM

WDX



EDAX



EBSD

Poďakovanie

Tvorivý pracovníci
Katka Zmorayová
Martina Šefčiková
Marika Kaňuchová
Vitalij Antal
Viktor Kavečanský

Doktorandi
Daniela Volochová
Samuel Piovarči
Monika Kalmanová

Technický pracovník
Peter Kulík