NAZARBAYEV UNIVERSITY

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ADVANCED ENERGY STORAGE SYSTEMS AND FUNCTIONAL NANOMATERIALS RESEARCH GROUP

ABSTRACT BOOK

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Nazarbayev University, Al-Farabi Kazakh National University, Institute of Batteries LLP, Nazarbayev University Research and Innovation System, National Laboratory Astana

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11.50 – 12.10 M.Jaeger[1], D.Adair[2] [1]School of Engineering & ICT, University of Tasmania, Australia. [2]School of Engineering, Nazarbayev University, Kazakhstan	Conceptual design of a high-endurance hybrid electric unmanned aerial vehicle	11.50 – 12.10 A.E.Nurtazina, M.B.Dergacheva, N.N.Gudeleva, G.M.Khussurova, K.A.Urazov *D.V. Sokolsky Institute of Fuel, Catalysis and Electrochemistry, Kazakhstan*	The electrodeposition of Se films on glassy carbon electrode
12.10 – 12.30 A.Mentbayeva[1,2], Z.Seitzhan[1], M.Aussat[1], Y.Massalin[1,2], K.Korzhynbayeva[1,2], I.Kurmanbayeva[1,2], Z.Bakenov[1,2] [1]*Nazarbayev University,* [2]*Institute of Batteries National Laboratory Astana, Kazakhstan*	Thin and uniform clay-containing LbL coatings on separator for lithium-sulfur batteries	12.10 – 12.30 K.Amangeldiuly, N.Kuzhagalieva *School of Engineering, Nazarbayev University, Kazakhstan*	Synthesis of high purity and size controlled silver nanoparticles for subsequent removal of mercury (II) ions from aqueous solutions
12.30 – 12.50 A.M.Tobysheva, K.A.Ablayeva, M.S.Lepikhin, A.P.Kurbatov, A.K.Galeyeva *Al-Farabi Kazakh National University, Kazakhstan*	A review of growth mechanism of anodized titanium dioxide nanostructure	12.30 – 12.50 S.Tolendiuly[1], R.G.Abdulkarimova[1], A.M.Akimkhan[1], A.Esbosyn[1], S.M.Fomenko[2], Z.A.Mansurov[2] [1]*Al-Farabi Kazakh National University, Kazakhstan* [2]*Institute of Combustion Problems, Kazakhstan*	Self-propagating high temperature synthesis of superconductors based on MgB_2 under the condition high-pressure of Ar

12.50-14.00 **Lunch time**

14.00-15.00 **Plenary Session Invited Talks (Conference Room #3, Library, 4th floor)**
A1 Chairmen: Prof. J.P. Pereira-Ramos, Prof. N. Kosova

14.00 – 14.30	J.P.Pereira-Ramos, M.Safrany-Renard, D.Muller-Bouvet, R.Baddour-Hadjean	The γ'-V_2O_5 phase: a new high voltage cathode material for sodium-ion batteries	*Institut de Chimie et des Matériaux Paris-Est, GESMAT, UMR 7182 CNRS-Université Paris Est Créteil, France*

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Self-propagating high temperature synthesis of superconductors based on MgB_2 under the condition high-pressure of Ar

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Abstract

In the present paper, a single-step SH-synthesis of bulk MgB_2 using thermal explosion under the pressure of argon is reported. The effect of high-pressure on the synthesis of MgB_2 superconducting materials on high critical current density J_c and the correlations between structure and properties of the materials is studied. MgB_2 has a transition temperature T_c of about 40 K, the highest in conventional superconductors and nearly two times the previous record in such superconductors. Bulk MgB_2 superconductor was synthesized from elemental magnesium and boron powders in a thermal explosion mode of Self-propagating High-temperature Synthesis under the pressure of 25 atm. The XRD pattern of the as-synthesized product indicates an almost complete conversion of the reactants to the MgB_2 single phase. Most of the diffraction peaks correlate with the MgB_2 polycrystalline bulk material.

Impurities comprise less than 24.3% of total mass and are identified as MgO and MgB_4 secondary phases. The typical morphology of prepared polycrystalline bulk MgB_2 sample consists of heterogeneously distributed grains having particle conglomerates. It is stated, the preparation of dense MgB_2 bulk superconducting material through single-step SHS method under Ar gas pressure is beneficiary to enhance the critical current density J_C. The average size of MgB_2 particles as determined from SEM was 200 to 300 nm. The general behavior of magnetization for as-synthesized MgB_2 sample by SHS method under the pressure of Ar gas is very similar to that of conventional MgB_2superconductor polycrystalline materials. The negative signals in the zero-field-cooled (ZFC) curve clearly indicate a SC state with an onset transition temperature at $T_C = 39$ K. We estimated the value of critical current density J_c of the obtained sample using the magnetization hysteresis loop and calculated the final data by Bean's critical model formulas [1], where the value of critical current density J_c was $5x10^8$ A/cm^2. Earlier, such approach was successfully used for production of MgB_2 with high critical current density in Ar medium [2]. We succeeded in the synthesis of MgB_2-based materials with critical current density (J_C) higher than those reported by Kijoon H. P. Kim et al. [3]. The attained level of superconductivity of the high-pressure synthesized MgB_2 and the possibility to produce large bulk MgB_2 products make this material very promising for practical applications.

References

[1] C.B. Bean, Rev. *Mod. Phys.* 36 (1964) 31. [2] K. Przybylski et al., *Physica C*, 387 (2003) 148–152. [3] Kijoon H. P. Kim, W. N. Kang et al. *Physica C* 370, 13-16 (2002).