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OXYFLUORIDE-BOROSILICATE GLASSES DOPED WITH Gd_2O_3

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The goal of this study was to obtain oxyfluoride glasses based on borosilicate glass network, which could be transformed into glass-ceramics containing the low phonon phase. Based on the previously performed research on formation of LaF_3 in the glass the possibility of obtaining gadolinium based fluorine phase in glassy matrix was studied. In this experiment series of glass in SiO_2-B_2O_3-Na_2O-NaF-Gd_2O_3-BaF_2 system was obtained with ratio B_2O_3/(2NaF+BaF_2+Na_2O+3Gd_2O_3) from 0,6 to 1,0. The thermal stability of the glass was studied using DTA/DSC analysis. On this basis, glass annealing parameters were established and the glass-ceramics were prepared in the heat treatment process. The crystalline phases were studied using X-ray phase analysis. The transmission of glass in the visible and near-infrared was to investigated. FT-IR spectroscopy was used for characterization the structure of the materials. DTA/DSC results proved, that the oxide glass matrix does not show ability to crystallization. The obtained glass-ceramic materials contained two low-phonon, fluorine crystalline phases: $NaBa_5Gd_4F_{23}$ and $BaGdF_5$. Forming of double and triple fluorides indicates similar to modifiers: Na^+ and Ba^{2+} affinity of Gd^{3+} ions towards fluorine in these glasses. The transmission curves analysis shows high transmission of obtained glasses for both visible and near-infrared range. The shift of absorption edge towards shorter wavelength with higher content of SiO_2 was observed. Spectroscopic analysis in mid-infrared spectrum showed, that the glass matrix is mainly formed by [SiO_4], [BO_4] tetrahedrons, and trigonal planar [BO_3], which quantity highly depends on boron ions and modifiers ions ratio. With the ratio of 1.0 the increase of boroxylic groups is observed, that leads to phase separation.

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C9

THERMO-ELECTROMOTIVE FORCE OF MULTICOMPONENT COMPOSITES BASED ON THE REFRACTORY OXYGEN-FREE COMPOUNDS

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The possibility of use of thermoelectric transducers based on the refractory oxygen-free compounds, which have linear dependence of the thermo-electromotive force from temperature in the temperature range from 900 °C to 1750 °C, is investigated in the work for the first time. At maximum temperature thermo-electromotive force coefficient of these transducers is 10 times higher than coefficient of high-temperature metallic thermocouples. Thus, ceramic thermocouples are resistant to various gas environments (oxidation, renewable, neutral), molten metals, salts, slags.

It was found, that type of material of additive and morphology of composite microstructure are essential for a value of functional parameter. For materials with approximately equal thermo-electromotive force coefficient (TiB_2, TaN), which are used as additives of the negative branch, in contact with composites of positive branch (fillers: soot and carbon fiber), thermo-electromotive force value is determined by microstructure of positive branch morphology: so when carbon fiber is used as filter, thermo-electromotive force of functional element is 3 times higher. If fillers with thermo-electromotive force coefficients which differ by about 5 times (TaN i ZrC) are used in negative branch and thermo-electromotive force coefficients of fillers in the positive branch are approximately equal but have different morphology (carbon fiber and boron carbide powder) – resulting values of thermo-electromotive force coefficients of functional element coincide accurate to the measurement error.

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BIOMORPHIC GROWTH AND FUNCTIONAL PROPERTIES OF NICKEL OXIDE 1-D MICROSTRUCTURES

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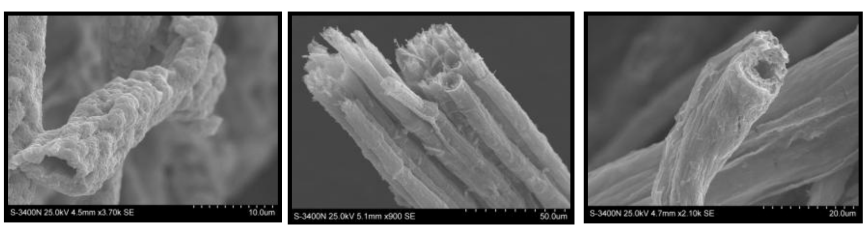
Natural evolution has provided numerous examples of exceptional building materials. Therefore, a variety of bio-inspired morphology synthesis strategies are being explored through processes of *in situ* modification with bio-templates because of their structural and compositional hierarchical order. Nickel oxide is an important semiconductor and antiferromagnetic material, widely used in electrochemical, optical and magnetic applications and its functionality greatly depends on its nano-/microscale [1]. 1-D structures are receiving significant attention because of their potential applications in energy conversion, separation science, environmental protection and chemical sensors [2].

The aim of this work was to prepare pure phase biomorphic 1-D NiO microtubes by using natural fibers as bio-template and to study the effects of the synthesis parameters (bio-template, calcination temperature, precursor concentration) on their microstructure and functional properties. The final products were obtained by infiltration of biotemplates (Cotton - Gossypium, Hemp - Cannabis sativa and Flax - Linum usitatissimu, Fig. 1) with nickel nitrate solution at different concentrations, followed by calcination in air, at different temperatures. The phase formation and morphologies have been investigated by using X-ray diffraction (XRD) and scanning electron microscopy (SEM) (Fig. 1). The influence of the synthesis parameters and templates on the functional characteristics of the 1-D NiO samples was determined and interpreted in terms of their nano/microstructural properties.



a) *b)* *c)*

Figure 1. SEM image of biomorphic NiO produced by using cotton (a), hemp (b) and flax (c) as biotemplates

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