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Pre-ceramic organomagnesium oxane-yttrium oxane alumoxanes: Synthesis, properties and pyrolysis

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Statement of the Problem: Development of efficient synthesis methods of ceramics forming element oxane oligomers – precursors for the production of components (binders, impregnating compositions, fibers, powders) of highly pure ceramic composites based on aluminum, yttrium and magnesium oxides ($Y_3Al_5O_{12}$, $MgAl_2O_4$, $\alpha-Al_2O_3$).

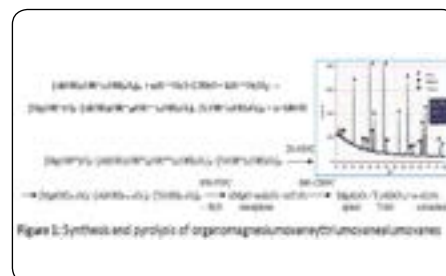
Methodology & Theoretical Orientation: Organomagnesium oxane-yttrium oxane alumoxanes were prepared by magnesium and yttrium acetylacetonates co-condensation with ethyl acetoacetate ethoxyhydroxy alumoxanes. Organometallic synthesis provides high purity, perfect nanostructure and unchallenged physic-mechanical properties of ceramic composites based on organomagnesium oxane-yttrium oxane alumoxanes.

Findings: Ceramics forming organomagnesium oxane-yttrium oxane alumoxanes with the specified molar ratio of Al:Y and Al:Mg hydrolytically stable in air and soluble in organic solvents have been synthesized.

Conclusion & Significance: Thermal transformation of organomagnesium oxane-yttrium oxane alumoxanes results in the production of $Y_3Al_5O_{12}$, $MgAl_2O_4$, $\alpha-Al_2O_3$, that is, similar oligomers can be used to create a new generation of heat-resistant, optically transparent, corrosion and radiation-resistant ceramic composites. The particular advantages in the use of ceramic forming organoelement oligomers consist in the ability to control the composition and structure of ceramic compositions at all levels (microcrystalline, nanostructured or amorphous), which cannot be completely achieved by any other known methods.

Recent Publications:

1. Shcherbakova G, Storozhenko P et al. (2012) Synthesis of yttrium-containing organoalumoxanes. *Inorganic Materials* 48:1058-1063.
2. Shcherbakova G, Storozhenko P et al. (2017) Pre-ceramic organomagnesium oxane alumoxanes: Synthesis, properties and pyrolysis. *Polyhedron* 135:144–152.
3. Liu Y, Zhang Z, Halloran J and Laine R (1998) Yttrium aluminum garnet fibers from metalloorganic precursors. *Journal of the American Ceramic Society* 81:629-645.
4. Liu Y and Laine R M (1999) Spinel fibers from carboxylate precursor. *Journal of the European Ceramic Society* 19:1949-1959.



Biography

Galina I Shcherbakova has completed Doctor of Chemistry (2009) and she is a leading Researcher of the State Research Institute for Chemistry and Technology of Organoelement Compounds. Her scientific interests include synthesis, structure and reactivity of organoelement and organometallic compounds; fundamentals of new materials creation; nanoparticles, nanomaterials; development of new structural materials and coatings.

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