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# Preceramic organomagnesiumoxaneyttriumoxanealumoxanes: synthesis, properties and pyrolysis

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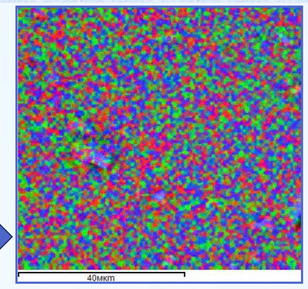
**State Research Institute for Chemistry and Technology of Organoelement Compounds, Moscow, Russia**

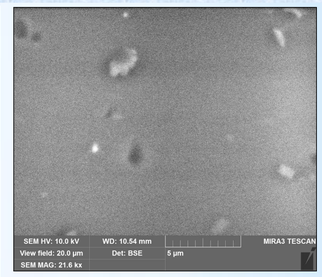
The task of our research is the development of a method for the synthesis of ceramic-forming organomagnesiumoxaneyttriumoxanealumoxanes that can be used as precursors for the preparation of components (binders, impregnating compositions, fibers, ceramic powders) of high-purity ceramic composites based on aluminum, yttrium and magnesium oxides, in particular, alumoyttrium garnet ($Y_3Al_5O_{12}$) and perovskite ($YAlO_3$), modified by magnesium oxide, spinel ($MgAl_2O_4$) modified by yttrium oxide, as well as corundum (α-$Al_2O_3$), modified by yttrium and magnesium oxides.

$$[Al(OR)_s(OR^{**})_x(OH)_pO_q]_m + a(R^*O)_3Y \cdot 2{,}5H_2O + k\,(R^*O)_2Mg \rightarrow (s-l)ROH +$$

$$+ [(R^*O)MgO]_k \cdot [Al(OR)_l(R^*O)_g(OR^{**})_x(OH)_zO_y]_m \cdot (R^*O)_hY(OH)_tO_r]_a$$

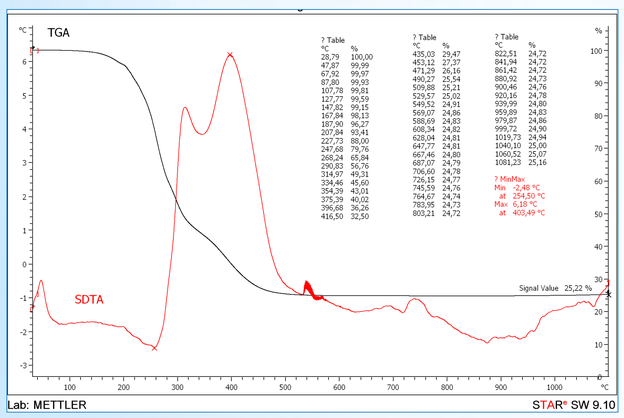
a, k = 0,1-6, m = 3-12; s+x+2q+p = 3; k/m+l+g+x+2y+z = 3; h+2r+t = 3;
R - $C_nH_{2n+1}$, n = 2,4; R* - $C(CH_3)=CHC(O)CH_3$; R** - $C(CH_3)=CHC(O)OC_2H_5$

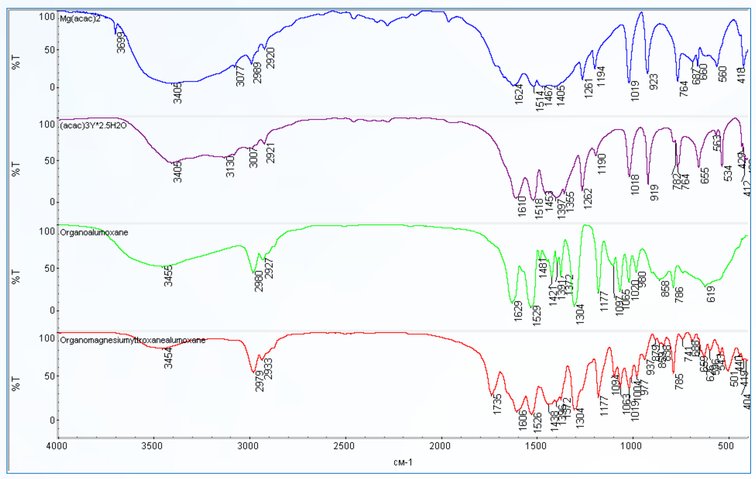



Elemental mapping with overlay elements on the same map showed that the elements included in the oligomer are distributed evenly.

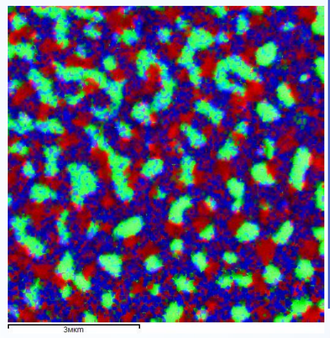
The thermogram of organomagnesiumoxaneyttriumoxanealumoxanes



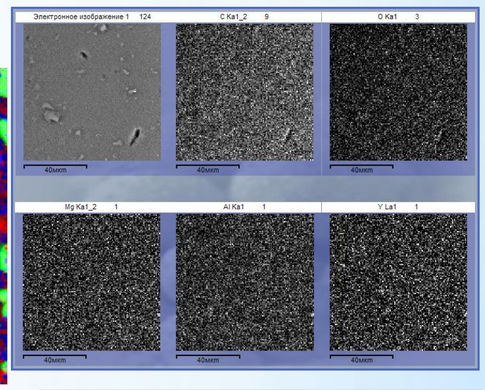



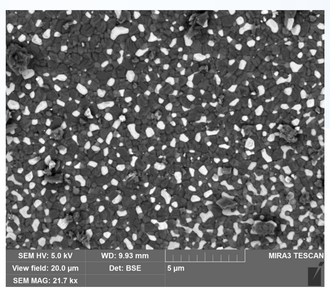

IR spectra starting compounds and organomagnesiumoxaneyttriumoxanealumoxanes

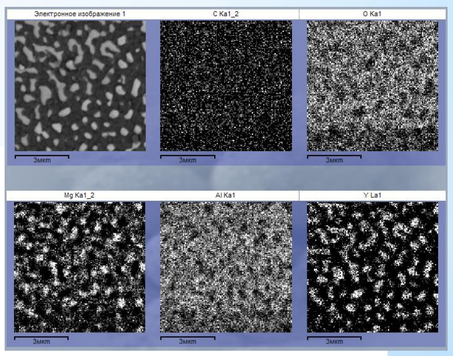
AlYMg




After heat treatment (1300 °C ) and destruction of organomagnesiumoxaney ttriumoxanealumoxane, along with the removal of the carbon fragments from its chemical composition, its volume splitting into separate structural micronutrients.

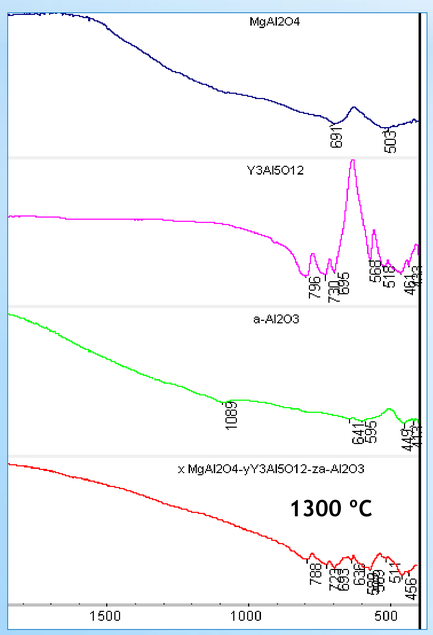


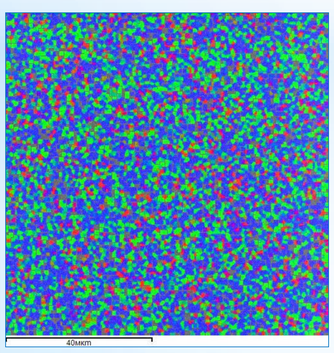




$$[Mg(OR^*)O]_k \cdot [Al(OR)_l(OR^*)_g(OR^{**})_x(OH)_zO_y]_n \cdot [Y(OR^*)_s(OH)_tO_r]_m \xrightarrow{20\text{-}450\ ^oC} -(C_nH_{2n}, CO_2, C_2H_4, CH_3CCH)$$

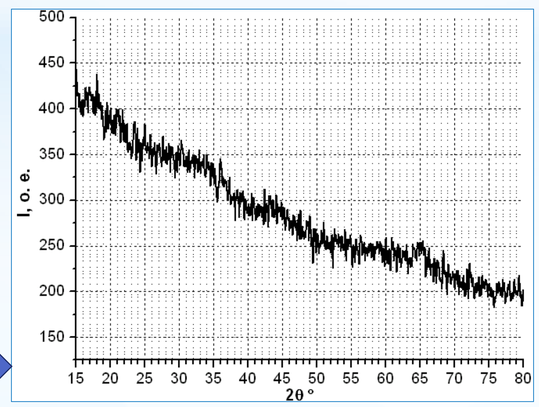
$$\rightarrow [Mg(OH)_{t+s}O_r]_k \cdot [Al(OH)_{t+x+z}O_y]_n \cdot [Y(OH)_{t+s}O_r]_m \xrightarrow[-H_2O]{450\text{-}550^oC} \underset{\text{amorphous}}{kMgO \cdot nAl_2O_3 \cdot mY_2O_3} \xrightarrow{800\text{-}1000^oC} \underset{(\gamma, \delta, \theta, \eta, \varepsilon)\ Al_2O_3}{kMgO \cdot nAl_2O_3 \cdot mY_2O_3} \xrightarrow{1000\text{-}1300^oC} \underset{\text{spinel}}{MgAl_2O_4} \cdot \underset{\text{YAG}}{Y_3Al_5O_{12}} \cdot \underset{\text{corundum}}{\alpha\text{-}Al_2O_3}$$

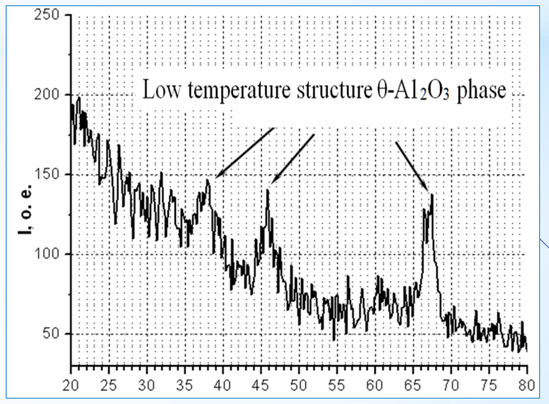


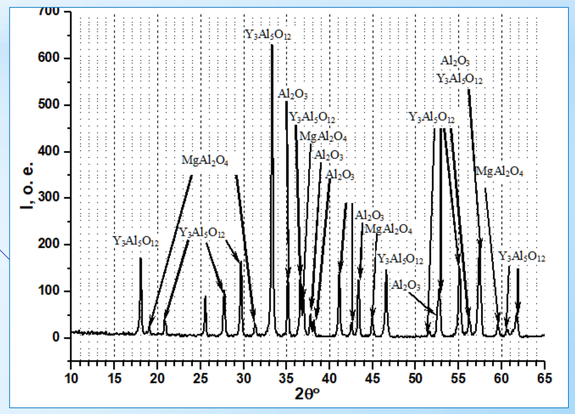




AlYMg

IR spectra:
- $MgAl_2O_4$
- $Y_3Al_5O_{12}$
- α-$Al_2O_3$
- $xMgAl_2O_4 \cdot yY_3Al_5O_{12} \cdot z\alpha\text{-}Al_2O_3$




750 °C 900 °C 1300 °C

**Diffraction patterns of magnesium yttrium aluminum oxide powders**

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