Phase States Cycling Sequence in Complex Oxides Received by Decomposition of the Melt-Solution of the Simple Oxides (Nitrates) in NH_4NO_3

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$Y_3Al_5O_{12}$, $Y_3Ga_5O_{12}$ (garnets), $YAlO_3$, $LaAlO_3$ (perovskites) $LuBO_3$, $GdBO_3$ $(Lu_xGd_{(1-x)})BO_3$, YBO_3 (borates) and $Eu_2(MoO_4)_3$ (molybdates) have been received by the dissolution of simple oxides (or nitrates) in the melt of NH_4NO_3 and by the following decomposition of the solvent at the increasing temperature. Amorphous like precursor states have been received as a result of such procedure. X-ray analysis has shown that the consequent annealing of the precursors at elevated temperatures gives a row of structure states which are characterized by the cyclic sequence of phases known for solid state synthesis.

For example, α-phase is known for macro-sized samples of $Eu_2(MoO_4)_3$ at low temperature. It undergoes phase transition into β-phase at ~800 C. In the case of annealing of the precursor of $Eu_2(MoO_4)_3$ the phase sequence is as follows: β-phase (not α-phase) arises at~500 C before other things, then it transforms into α-phase at ~600 C and finally, at T>800 C α-phase undergoes a phase transition into β-phase again. Simultaneously the dimensions of the synthesized crystallites are changed from nano- into micro- and then into macro-scale.

The explanation of the phenomenon is based on the assumption that the temperature of phase transitions depends on the total energy only and that this energy depends on the crystallite sizes.

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