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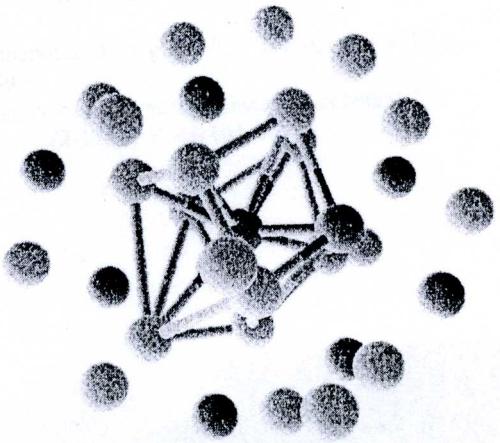

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Thermodegradation kinetics in monolithized spinel ceramics

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Functional spinel ceramics are one of the most perspective materials for device application as negative temperature coefficient thermistors. To eliminate the degradation, the method of chemical modification of ceramics at the initial technological stages is used at the example of $Cu_{0.1}Ni_{0.8}Co_{0.2}Mn_{1.9}O_4$ ceramics. Synthesis of optimal thermally-sensitive elements was performed owing to technological conditions for inhibition effects in degradation, the content of NiO phase (1 % - batch 1, 8 % - batch 2, 10 % - batch 3, 12 % - batch 4 and 12 % - batch 5 obtained at different amounts of thermal energy transferred during the sintering) having a decisive role on final ceramics structure.

The results of ageing tests were controlled by relative resistance drift (RRD) caused by ceramics storage at the temperature of 170 ^{0}C. The value of RRD for batch 1 (sintered at 1040 °C) with fine grains of 1–3 μm is higher (near 30 %). The extremely small value of RRD near 2.5 % is character for samples of batch 2 (sintered at 1200 °C) having 8 % of additional NiO phase, while ceramics samples of batches 3, 4 and 5 are monolithized having amount of NiO phase near 10 % (for batch 3) and 12 % (for batches 4 and 5). Sintered at higher temperature of batch 5 (1300 °C) demonstrate sharp increase in RRD up to 18%.

This kinetics behaviour in spinel-type ceramics is shown to be adequately described by stretched-exponential relaxation function [1]. The extraction of additional NiO phase from $Cu_{0.1}Ni_{0.8}Co_{0.2}Mn_{1.9}O_4$ ceramics enlarges the dispersivity of the system, while the monolithization of ceramics causes an opposite effect. The non-exponentionality index κ grows from 0.2 (batch 1) to 0.4 for batch 2 ceramics, the similar increase being character for time constant τ too. However, the further increase in NiO content from 10 (batch 3) to 12 % (batches 4 and 5) is associated with principally different processes of microstructural evolution corresponding to rash monolithization. The non-exponentionality index κ is most close to 0.4. Such thermodegradation behaviour can be explained in terms topological relaxation model [2].

1. Mazurin O.V. Relaxation phenomena in glass // J. Non-Cryst. Solids. – 1977. – Vol. 25. – P. 130-169.
2. Phillips J.C. Microscopic theory of Kohlrausch relaxation constant β_k // J. Non-Cryst. Sol. – 1994. – Vol. 172-174. – P. 98-103.