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New Frontiers in Multifunctional Material Science and Processing

Serbian Ceramic Society
Institute of Chemistry Technology and Metallurgy
Institute for Technology of Nuclear and Other Raw Mineral Materials
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Influence of MoO_3 on sintering temperature of mechanically activated $MgO-Al_2O_3-SiO_2$ system

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Cordierite, $2MgO{\cdot}2Al_2O_3{\cdot}5SiO_2$, is a very attractive high-temperature ceramic material, due to its outstanding electrical characteristics, such as the low temperature expansion coefficient, low dielectric constant and good mechanical properties. In order to accelerate the process of sintering, 5.00 mass% MoO_3 has been added to the starting mixtures. The mechanical activation of the starting mixtures was performed in a high energy ball mill during 0-80 minutes. The particle size analysis (PSA) was employed in order to determine the changes in the particle size of the mechanically treated powders. The phase composition of the starting powders and sintered samples was analyzed by the X-ray diffraction method. Furthermore, differential thermal analysis (DTA) was used in order to determine characteristic temperatures within the system during heating. Based on the obtained DTA results, it was established that mechanical activation has some influence on temperatures of phase transitions. Sintering process was performed in air at 1200^{o}C for 2h.

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Structural characterization of mechanically activated $MgO-TiO_2$ system

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In this article the influence of ball miling process on structure of $MgO-TiO_2$ system was investigated. The mixtures of $MgO-TiO_2$ powders were mechanically activated in a planetary ball mill for the time period from 0 to 120 minutes. The influence of mechanical activation on the lattice vibrational spectra was studied by Raman spectroscopy at room temperature. Structural investigations have been performed on produced powders. Nitrogen adsorption method was used to determine the BET specific surface area and pore size distribution. Unusual results have been obtained: specific surface area continuosly decreased up to 40 minutes of activation and increased after that, reaching its minimun value of 5.5 m^2/g. The Raman spectra of activated powders have shown that anatase modes have been decreasing in intensity and broadening as the time of

activation extended. Also, the additional modes attributed to TiO_2 II, srilankite and rutile phases started to appear as a consequence of activation.

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Annealing and doping concentration effects of Y_2O_3: Sm^{3+}nanopowder obtained by self-propagation room temperature reaction

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In this report, structure, morphology and luminescence of Y_2O_3:Sm^{3+}nanoparticles prepared by self-propagating room temperature reaction are presented. This new, simple and cost effective synthesis allows obtaining desired phase composition by mixing appropriate amounts of yttrium and samarium nitrates together with sodium hydroxide. A set of samples is prepared with different Sm^{3+}concentrations (0.1, 0.2, 0.5, 1 and 2 at %) in order to observe changes of luminescence properties. Also, effects of post synthesis annealing at several temperatures (600 °C, 800 °C and 1100 °C) are analyzed. For all samples X-ray diffraction showed that powders have cubic bixbyite structure (Ia-3), and TEM analysis showed particles of about 50 nm. Luminescence emission spectra clearly show peaks characteristic for electronic spin-forbidden transition of Sm^{3+} ions $^4G_{5/2}\rightarrow{}^6H_{5/2}$, $^6H_{7/2}$ and $^6H_{9/2}$ centered at 578, 607 and 654 nm, respectively. Emission lifetime values decrease with Sm^{3+} ion concentration increments, from 1.94ms for 0.1 at% to 0.97 ms for 2 at%. In addition, enlargement of lifetime values observed when thermal treatment is done at the highest temperature due to the elimination of luminescence quenching species from the surface of particles.

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Effect of processing parameters on structural and morphological Y_2O_3 :Yb^{3+}/Ho^{3+} powders characteristics

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Up-converting yttrium oxide powders doped with Yb^{3+} and co-doped with Ho^{3+} were synthesized through hydrothermal processing at 200 °C/3 h. Reverse precipitation of the starting nitrates mixture is performed with the help of ammonium hydrogen carbonate (AHC) solution up to pH 7 or pH 9 prior to hydrothermal treatment. Morphological features of the as-prepared (asp) powders and rare earth oxides obtained after powders additional annealing at 1100 ^oC (3 and 12 h) are discussed based on X-ray powder diffractometry (XRPD), scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS). Structural refinement confirmed generation of the cubic bixbyte-structure (S.G. *Ia*-3) with non-uniform accomodation of dopants at C_2 and S_6 cationic sites. SEM revealed that the particles have plate-like or rod-like morphology in dependence of hydrothermal processing (pH). Due to the fact that are composed from nanograins (30-100 nm) they