Serbian Ceramic Society Conference
ADVANCED CERAMICS AND APPLICATION X
New Frontiers in Multifunctional Material Science and Processing

Serbian Ceramic Society
Institute of Technical Sciences of SASA
Institute for Testing of Materials
Institute of Chemistry Technology and Metallurgy
Institute for Technology of Nuclear and Other Raw Mineral Materials

PROGRAM AND THE BOOK OF ABSTRACTS

Serbian Academy of Sciences and Arts, Knez Mihailova 35
Serbia, Belgrade, 26-27. September 2022.

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Deviation measurement of SLS PA material regarding location and orientation of printing

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SLS technology is widely used in several industries worldwide mainly due to its ability to manufacture complex geometry components with less effort compared to conventional methods. Such technology uses materials in powder form, the most common ones are polyamides (PA), polystyrenes, thermoplastic elastomers, and polyaryletherketones. Research covers flexural PA12 specimens, with CAD model dimensions selected according to the ISO 178 standard, with 96x8x4 [mm] in bulk. Printing was performed on Fuse 1 (FormLabs, Summerville, MA) machine with four batches, differing in printing orientation and printing location. Vertical and horizontal orientations are applied, and each orientation is combined with the printing location, i.e., in the middle and on the edge of the powder bed. Printed specimens are scanned and obtained scans are then compared with original CAD model in the GOM Inspect program. All four specimen batches have deviation maximum on lateral sides, where the surface is minimal. Nearly 0.42 mm deviations are present in horizontally printed specimens placed in the middle of the powder bed, and these values are maximal recorded deviations. Worth mentioning are vertical specimens printed in the middle, which show not only lateral deviations but posses 0.07 mm deviations on largest surface, i.e., on 96x8 mm one.

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Optically active $SrGd_2O_4$ phase: Yb^{3+}/Ho^{3+} and Yb^{3+}/Tm^{3+} co-doping

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Optically active materials have a wide range of applications. The phenomenon of light conversion includes two main types: up-conversion, which is the ability of convertion lower energy photons into the ones with the higher energy, and down-conversion, which is vice versa. Orthorhorhombic $SrGd_2O_4$ doped with rare earth elements is established to have promising optical characteristics, but rarely explored until nowadays as up-converting material. Due to the phonon energy of around 475 cm^{-1}, which is lower than in many other compounds commonly used hosts, this one has a great perspective as an optically active

material. Here, for the first time two combinations of rare earth dopant ions, Yb^{3+}/Ho^{3+} and Yb^{3+}/Tm^{3+}, with different mutual ratios were chosen as pairs for inducing up-conversion. Sol-gel assisted combustion synthesis, which comprises citric acid as chelator and glycine as fuel, was used to obtain powdered samples that are subsequently thermally treated for 3.5 h at 1100°C. X-ray powder diffraction analysis (XRPD) was performed to determine crystal structure. Morphology characteristics were observed by scanning and transmission electron microscopy (SEM/TEM). Photoluminescent up-converting properties were measured in function of laser power (976 nm) in order to define optimal doping concentration and up-conversion mechanism.

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Related effects of $Ca_{1-x}Gd_xMnO_3$ (x = 0.05, 0.1, 0.15, 0.2) compound

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We have used theoretical and experimental methods to investigate the octahedral tilting and related effects of $Ca_{1-x}Gd_xMnO_3$ (x=0.05, 0.1, 0.15, 0.2) compound. Both methods have shown that orthorhombic-perovskite structure (space group *Pnma*) is the most stable form and according to Glazer's classification belongs to $a^-b^+a^-$ tilt system. Our bond valence calculations (BVC) have shown ten additional perovskite-related modifications of the equilibrium $Ca_{1-x}Gd_xMnO_3$ structure, and their stability has been investigated as function of Gd doping. We have further studied the influence of gadolinium amount on Mn-O bond angles and distances, tilting of MnO_6 octahedra around all three axes and deformation due to the presence of Jahn-Teller distortion around Mn^{3+} cation, and calculated the amount of Mn^{3+} in the system. The infrared reflection spectra of $Ca_{1-x}Gd_xMnO_3$ samples confirmed XRD results that $Ca_{1-x}Gd_xMnO_3$ nanopowders are of *Pnma*-1 structure and that the tilting of octahedra are increased with Gd doping. The EPR spectra are in accordance with the assumption that EPR linewidth is Mn-O-Mn angle dependent. The studied samples showed that small octahedra tilting in these samples brought only a small change of the EPR linewidth.