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Fabrication of Dy^{3+} Ion Doped Nano Crystalline Y_2O_3 Infrared Transparent Ceramics by a Microwave Sintering Technique

Steffy Maria Jose[1]*, Swapna Y V[2], C T Mathew[3] and **Jijimon K Thomas[4]**
Department of Physics, Kerala University, Kerala

Synthesis of high quality Dy^{3+} ion doped Y_2O_3 starting powder by a modified combustion technique followed by microwave sintering technique for the fabrication of high dense infrared transparent ceramics is presented in the paper. The as-prepared nanocrystalline powders are characterized using X-ray diffraction (XRD) to study their structure and phase. Dy^{3+} ion is added to Y_2O_3 matrix at different concentrations for tuning the physical properties and we have optimized a system $Dy_{0.1}Y_{1.9}O_3$ exhibiting relatively improved optical thermal, and transmittance and properties. All the peaks of $Dy_{0.1}Y_{1.9}O_3$ were indexed for a cubic structure with lattice parameter a = 10.623 Å. The average crystal size calculated for the sample using Debye-Scherer's equation, is ~7.719 nm. The $Dy_{0.1}Y_{1.9}O_3$ Nanoparticles are compacted to pellets using a hydraulic pressing followed by sintering using microwave energy in a microwave furnace at an optimum temperature 1530 ^{0}C and obtained an enhanced sintered density of 98.6% of theoretical density. The well sintered pellets are subjected to micron sized fine polishing, followed by thermal etching for carrying out the morphological investigations using Scanning Electron Microscopy (SEM). The Poly crystalline Dy^{3+} ion doped yttria ceramics ($Dy_{0.1}Y_{1.9}O_3$) shows 76% transmittance in 3-8 μm infrared regions. The result clearly indicates that Dy^{3+} ion doped Y_2O_3 sample can be effectively used to fabricate infrared transparent ceramics material.

Biography:

Ms. Steffy Maria Jose is a first year Ph.D student in Materials Science and Nanotechnology at the University of Kerala, India. Prior to her present affiliation at the University of Kerala, she earned a Master's and M.Phil degree in Physics both from Mahatma Gandhi University, Kerala, India. She gained research interest during her Master's and M. Phil programme in Physics and gained basic knowledge in research methodology. Currently she is doing research in the synthesis of yttria based nanoceramics and composites for their applications as infrared transparent window materials for missile applications at the Electronic Materials Research Laboratory,Department of Physics, Mar Ivanios College (Autonomous), University of Kerala.