World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:11, No:01, 2017

Sintering of YNbO3:Eu3+ Compound: Correlation between Luminescence and Spark Plasma Sintering Effect

Authors : Veronique Jubera, Ka-Young Kim, U-Chan Chung, Amelie Veillere, Jean-Marc Heintz

Abstract : Emitting materials and all solid state lasers are widely used in the field of optical applications and materials science as a source of excitement, instrumental measurements, medical applications, metal shaping etc. Recently promising optical efficiencies were recorded on ceramics which result from a cheaper and faster ways to obtain crystallized materials. The choice and optimization of the sintering process is the key point to fabricate transparent ceramics. It includes a high control on the preparation of the powder with the choice of an adequate synthesis, a pre-heat-treatment, the reproducibility of the sintering cycle, the polishing and post-annealing of the ceramic. The densification is the main factor needed to reach a satisfying transparency, and many technologies are now available. The symmetry of the unit cell plays a crucial role in the diffusion rate of the material. Therefore, the cubic symmetry compounds having an isotropic refractive index is preferred. The cubic Y3NbO7 matrix is an interesting host which can accept a high concentration of rare earth doping element and it has been demonstrated that SPS is an efficient way to sinter this material. The optimization of diffusion losses requires a microstructure of fine ceramics, generally less than one hundred nanometers. In this case, grain growth is not an obstacle to transparency. The ceramics properties are then isotropic thereby to free-shaping step by orienting the ceramics as this is the case for the compounds of lower symmetry. After optimization of the synthesis route, several SPS parameters as heating rate, holding, dwell time and pressure were adjusted in order to increase the densification of the Eu3+ doped Y3NbO7 pellets. The luminescence data coupled with X-Ray diffraction analysis and electronic diffraction microscopy highlight the existence of several distorted environments of the doping element in the studied defective fluorite-type host lattice. Indeed, the fast and high crystallization rate obtained to put in evidence a lack of miscibility in the phase diagram, being the final composition of the pellet driven by the ratio between niobium and yttrium elements. By following the luminescence properties, we demonstrate a direct impact on the SPS process on this material.

Keywords : emission, niobate of rare earth, Spark plasma sintering, lack of miscibility
Conference Title : ICSSC 2017 : International Conference on Solid State Chemistry
Conference Location : London, United Kingdom
Conference Dates : January 19-20, 2017