World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:17, No:10, 2023

Crystallization in the TeO2 - Ta2O5 - Bi2O3 System: From Glass to Anti-Glass to Transparent Ceramic

Authors : Hasnaa Benchorfi

Abstract : The Tellurite glasses exhibit interesting properties, notably their low melting point (700-900°C), high refractive index (≈2), high transparency in the infrared region (up to 5−6 µm), interesting linear and non-linear optical properties and high rare earth ions solubility. These properties give tellurite glasses a great interest in various optical applications. Transparent ceramics present advantages compared to glasses, such as improved mechanical, thermal and optical properties. But, the elaboration process of these ceramics requires complex sintering conditions. The full crystallization of glass into transparent ceramics is an alternative to circumvent the technical challenges related to the ceramics obtained by conventional processing. In this work, a crystallization study of a specific glass composition in the system TeO2-Ta2O5-Bi2O3 shows structural transitions from the glass to the stabilization of an unreported anti-glass phase to a transparent ceramic upon heating. An anti-glass is a material with a cationic long-range order and a disordered anion sublattice. Thus, the X-ray diffraction patterns show sharp peaks, while the Raman bands are broad and similar to those of the parent glass. The structure and microstructure of the anti-glass and corresponding ceramic were characterized by Powder X-Ray Diffraction, Electron Back Scattered Diffraction, Transmission Electron Microscopy and Raman spectroscopy. The optical properties of the Er3+-doped samples are also discussed.

Keywords : glass, congruent crystallization, anti-glass, glass-ceramic, optics
Conference Title : ICOMG 2023 : International Conference on Optical Materials and Glass
Conference Location : New York, United States
Conference Dates : October 09-10, 2023