Title: Sm3+:Ag NPs assisted modification in absorption features of magnesium tellurite glass

Author/Authors: Nurulhuda Mohammad Yusoff, Md. Rahim Sahar, Sib Krishna Ghoshal

Abstract: Metallic nanoparticles (NPs) assisted enhancements in absorption and emission cross-section of tellurite glass is the present challenge. The influences of samarium (Sm3+) ions and silver (Ag) NPs ratio on physical and optical absorption properties of melt quench synthesized magnesium tellurite glasses are reported. XRD patterns verify the amorphous nature of glasses. Glass density, molar volume and ionic packing fraction are discerned to be in the range of 4.92-5.0 g cm-3, 29.82-30.26 cm3 mol-1 and 0.452-0.446, respectively. Moderate reduction potential of tellurite glass converted Ag1+ to Ag0 via single step process and NPs are formed. TEM image manifest the existence of NPs of average diameter ~16.94 nm having Gaussian size distribution. The significant changes in structural properties in the presence of Ag NPs are discussed in terms of TeO4 tetrahedra distortion and network depolymerization process. The Sm3+:Ag NPs dependent variation in physical properties are ascribed to the alteration in the number of bridging oxygen to non bridging (NB) one. Enhancement in absorption intensity due to the local field effects of Ag NPs is attributed to the changes in Sm-O bond strength. Optical energy band gap (2.81-3.18 eV) and Urbach energy (0.18-0.24 eV) are found increase and decrease, respectively with the increase of Sm3+:Ag NPs up to 1.33 then quenches and enhances, respectively thereafter which are related to the changes in cross-link and NBO numbers. The FTIR spectra reveal modification in network structures evidenced from vibrational wave-number shifts of TeO4 and TeO3 structural units. The observed notable increase in HOH vibration mode suggests its helpfulness in promoting the absorption of water and light. It is asserted that the physical, optical and structural properties of magnesium tellurite glass can be tuned by controlling Sm3+:Ag NPs.