Title: Strontium ion concentration effects on structural and spectral properties of Li4Sr(BO3)(3) glass

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Abstract: Optimizing the concentration of host borate glass system to achieve a superior thermal and structural stability is challenging for sundry applications. A series of lithium strontium borate (LSBO) glasses with composition of (85 - x) H3BO3 - 15Li2CO3 - xSrCO3, where x = 5, 7.5, 10, 12.5 and 15 mol% are prepared via melt quenching technique. Synthesized glasses are thoroughly characterized using XRD, FTIR, DTA, FESEM, PL, and UV-vis-NIR measurements to determine the influence of strontium (Sr2+) ion concentration on thermal, physical, and structural properties of the glasses. XRD pattern confirms the amorphous nature of all samples. The FESEM images verify their homogeneous and transmitting surface morphology. Physical properties are determined in terms of glass density, molar volume, molar refractivity, polaron radius, inter-nuclear distance, field-strength, and ion concentration. Glass density is found to increase from 2.53 to 2.95 g/cm3 with increasing Sr2+ ion contents. FTIR spectra exhibit the presence of two fundamental peaks in the range of 700-1070 cm-1 corresponding to the trigonal and tetrahedral stretching vibrations of BO3 and BO4 units. These peaks show a shift with the increase of modifier concentration. DTA results display peaks for glass transition, crystallization and melting at 500, 600 and 900°C, respectively. Prepared samples are highly stable with Hurby parameter ~ 0.5. The direct, indirect band gap and Urbach energy calculated from the absorption edge of UV-vis-NIR spectra lie within 3.4-3.8 eV and 3.84-3.93 eV, 3.84-3.25 eV, respectively. The observed increase in refractive index from 2.17-2.19 is ascribed to the conversion of BO4 into BO3 units. Room temperature PL spectra under 430 nm excitations display two peaks centered at 482 and 526 nm accompanied by slight peak shift towards the lower wavelength due to the formation of new complexes in the glass network. Results are analyzed via different mechanism and compared. Excellent features of the results nominate these compositions potential for solid state lasers, photonic devices, and optical fibers applications.