Low-Temperature Excess Heat Capacity and Boson Peak of Mixed Alkali Effect in Borate Glass

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Low-energy inelastic scattering spectra show a broad response called a boson peak (BP). The BP is the peak of g(E)/E2, where g(E) is the vibrational density of states (VDoS), and it originates from the low-energy excess of the VDoS over the Debye prediction. As another feature of BP, the heat capacity of glass at low temperatures shows the peak of C_p/T^3 vs. T plot, which is higher than the Debye level, and this peak is also related to the excess of VDoS. The mixed alkali effect is the anomalous composition dependence of physical properties in oxide network glasses. The low-temperature excess heat capacity was studied in co-doped alkali metal borate glass [1]. The heat capacity of rapidly quenched alkali metal borate glass [2,3] was measured using a relaxation calorimeter (PPMS). The universal nature of C_p/T^3 in the distribution of the low-energy excess VDoS is investigated. The relation between C_p/T^3 and the BP observed by inelastic scattering is also discussed.

References:

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