Study of magnetic properties of the rare-earth ion doped phosphate glass $Dy(PO_3)_3$

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An experimental study was conducted to investigate the magnetic properties of dysprosium-doped phosphate glasses. Low-temperature (LT) measurements of the specific heat of Dy(PO3)3 were performed in the range of 0.4 – 300 K in the magnetic fields up to 9 T. The LT specific heat of amorphous materials is characterized by the presence of a broad maximum named Boson peak (BP). The LT specific heat of the Dy-doped sample is dominated by the magnetic contribution, which overlaps the BP. Due to that reason, the specific heat of equivalent non-magnetic glasses was also measured at the same temperature range, revealing the BP at 12 – 15 K, depending on sample compositions. The magnetic susceptibility was measured from 1.8 K up to room temperature, yielding the effective magnetic moment 10.65 μ_B, which is close to the theoretical prediction for Dy3+. Magnetization curves were measured up to B = 5 T with temperatures ranging from 2 to 50 K. X-band Electron-paramagnetic resonance spectra were measured from 0 to 1 T, revealing a maximum at 100 mT. The line achieves maximal intensity at temperatures around 12 – 14 K, which coincides with the appearance of BP in specific heat. The coincidence suggests a possible correlation between lattice and magnetic properties. The experimental results and data analysis will be discussed.

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