Photoluminescence from PbSe and Sr2+-doped PbSe quantum dots embedded in silicate glass

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Abstract

Glasses doped with quantum dots (QDs) have been intensively investigated in recent years, duo to the tunable absorption and photoluminescence in a wide wavelength range induced by the quantum confinement effects. This work reports the photoluminescence from lead selenide (PbSe) and Sr2+-doped PbSe QDs in silicate glasses. PbSe QDs were precipitated in the glass system with nominal composition of 50SiO2-25Na2O-8.2ZnO-10BaO (or SrO)-5Al2O3-0.6PbO-1.2ZnSe (in mol%). When BaO was replaced by SrO, the Sr2+-doped PbSe QDs formed and showed large blue-shifts in both absorption and photoluminescence compared to the PbSe QDs. The incorporation of Sr into PbSe QDs leads to the increasing in the band gap, which resulted the large blue-shifts. The PbSe and Pb*1-x*Sr*x*Se QDs were excited with the pumper power from 100 to 600 mW at 294K. When the pumper power increased from 100 to 600 mW, the photoluminescence bands from the pure PbSe quantum dots showed a blue-shift of _˜4 meV, and the full width at half maximum (FWHM) increased from 168 to 204 nm. These changes were due to the increased in the local temperatures induced by pumper power. While, the photoluminescence bands from the Pb*1-x*Sr*x*Se quantum dots showed a red-shift of _˜26 meV, and the FWHM increased from 196 to 232 nm. This heating induced red-shift was attributed to the negative temperature coefficient dE/dT of the Pb*1-x*Sr*x*Se QDs.

Keywords: Sr2+ doped PbSe, laser induced heating, photoluminescence

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