Infrared Emitting PbSe Nanocrystals for Telecommunications Window Applications

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We demonstrate the synthesis of PbSe nanocrystal quantum-dots using colloidal chemistry techniques[1]. These nanocrystals are found to have highly efficient, infrared luminescence from intrinsic quantum-confined states[2]. Based upon the sharp exciton absorption and photoluminescence (PL) emission spectra, a particle size distribution with a standard deviation of approximately 5% may be inferred. The wavelength of the PL may also be conveniently size-tuned in order to access the 1.3-1.5 microns "telecommunications window"[3].

The characterisation of PbSe nanocrystals in a variety of different optical environments is also reported. In particular, we examine the incorporation of nanocrystals into photonic structures, such as planar waveguides, and also cylindrical microcavities. In solution, these nanocrystals may also have use in infiltrating photonic structures for the purpose of achieving "liquid gain". The possibilities for using PbSe nanocrystals in a wide range of optoelectronic and telecommunications applications are discussed in the context of this work.

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[2] R.D. Schaller, M.A. Petruska & V.I. Klimov, J. Phys. Chem. **107**, p13765 (2003)
[3] B.L. Wehrenberg, C. Wang & P. Guyot-Sionnest, J. Phys. Chem. B, **106**, p10634 (2002)