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Article

TemperatureÃƒÂ¢Ã‚€Ã‚•dependent Energy Transfer in MnÃƒÂ¢Ã‚€Ã‚•doped CdS/ZnS Nanocrystals[#]

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[#]This paper is dedicated to Professor Kwan Kim on the occasion of his honorable retirement.

Abstract

Temperature dependence of the exciton and luminescence intensities in MnÃƒÂ¢Ã‚Â€Ã‚Â•doped

CdS/ZnS quantum dots (QDs) emitting both exciton and dopant luminescence simultaneously was studied in the temperature range 77Ãƒ Â¢Ã‚Â€Ã‚Â“320Ãƒ Â¢Ã‚Â€Ã‚Â‰K. With increasing temperature, exciton luminescence intensity decreased as a result of the increased charge carrier trapping, similar to the usual undoped QDs. In contrast, the sensitized Mn luminescence intensity increased with increasing temperature despite the decrease in the exciton population available for the sensitization. The observed opposite temperature dependence of the exciton and Mn luminescence indicates that the excitonÃƒ Â¢Ã‚Â€Ã‚Â“Mn energy transfer rate should increase with temperature significantly more rapidly than the charge carrier trapping. Temperature shift of the bandgap of the host QD and the energy of accepting dÃƒ Â¢Ã‚Â€Ã‚Â“d transition, resulting in the variation of the donorÃƒ Â¢Ã‚Â€Ã‚Â“acceptor spectral overlap, is considered responsible for the large temperature dependence of the energy transfer rate in MnÃƒ Â¢Ã‚Â€Ã‚Â•doped QDs.

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