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Spectroscopic Analysis of Nd$^{3+}$:Y$_2$O$_3$ Nanocrystals for Photonic and Biomedical Applications ROBERT C. DENNIS, KELLY L. NASH, JOHN B. GRUBER, DHIRAJ K. SARDAR, UTSA — Spectroscopic properties are investigated for Nd$^{3+}$ in nanocrystalline Nd$^{3+}$:Y$_2$O$_3$. Room temperature absorption intensities of Nd$^{3+}$(4$f^3$) transitions in synthesized Nd$^{3+}$:Y$_2$O$_3$ nanocrystals have been analyzed using the Judd-Ofelt (J-O) approach in order to obtain the phenomenological intensity parameters. The J-O intensity parameters are used to calculate the spontaneous emission probabilities, radiative lifetimes, and branching ratios of the Nd$^{3+}$ transitions from the upper multiplet manifolds to the corresponding lower-lying multiplet manifolds $2S+1L_J$ of Nd$^{3+}$(4$f^3$). A comparison between the spectroscopic properties of the Nd$^{3+}$ nanocrystals suspended in epoxy, Chitosan, and 2-hydroxyethyl methacrylate (HEMA) has been performed. This study suggests that synthesized Nd$^{3+}$:Y$_2$O$_3$ nanocrystals could be an excellent alternative to single-crystal Ho$^{3+}$:Y$_2$O$_3$ for various photonic applications, in particularly biosensors, when used in the near infrared (0.8 to 0.9 µm) region. *This research was supported in part by the National Science Foundation Grant No. DMR-0602649 and the NSF-sponsored CBST at UC Davis under the cooperative agreement No. PHY-0120999.

Robert C. Dennis
UTSA

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