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Site-Selective Spectroscopy of Er-ions in Si/SiO2 films: SiO2 vs Si-nanocrystals[1] Z. FLEISCHMAN, V. DIEROLF, C. SANDMANN, M WHITE, Y. ZHAO, Lehigh University, J. MICHEL, M.A. STOLFI, L. DAL NEGRO, MIT — Using site-selective combined excitation-emission spectroscopy, we have investigated various Si/SiO_2 films that have been doped with Er^{3+} ions. In these films, the Er ions incorporate into many different lattice environments (sites) especially when Si-nanocrystals are present as well. This makes site-specific statements about important quantities, such as emission lifetimes and excitation efficiencies, very difficult. To circumvent this problem, we applied a site-selective excitation scheme in which the ions are excited in two steps using one or two laser sources capable of exciting two subsequent transitions. Applying this scheme under systematic variation of excitation wavelengths (around 1530nm) for the transitions from the $^4I_{15/2}$ ground state to the $^4I_{19/2}$ excited state via the $^4I_{13/2}$ state and detecting the emission (at 980 nm) from $^4I_{11/2}$ to $^4I_{15/2}$ leads to a significant line narrowing and a much clearer distinction of the emission features. This gives us the possibility to excite specific sites and study their properties individually. Comparing these results with photoluminescence measured under 488nm excitation, in which the Er-ions are excited through the excitation of the nanocrystals, allows a clear identification of sites that are related to nanocrystals and helps to identify those Er sites that are most effective in electrical excitation.

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