THE PHOTOLUMINESCENCE FROM HYDROGEN-RELATED SPECIES IN COMPOSITES OF SiO_2 NANOPARTICLES

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Dispersed photoluminescence (PL) spectra of silica (SiO_2) nanoparticles induced by ArF (193 nm) and Nd:YAG (266 nm) lasers have been observed.[a] PL measurements from the composites of silica nanoparticles (the primary particle size 7 and 15 nm) as a function of heat-treatment temperature show that the PL results from hydrogen-related species and thermally produced structural defects. The green PL exhibits a progression with spacings of $\Delta\nu \sim 630$ cm^{-1} assigned to the bending vibration of ≡Si-H on the surface of particles. The spacings increase up to $\Delta\nu \sim 1200$ cm^{-1} when ≡Si-H and non-bridging oxygen (≡Si-O•) form interfacial water species. The two-photon (TP) induced PL with an ArF laser excitation has also been studied. The TP-produced excitons can result in a self-trapped exciton recombination (blue band), surface hydrogen-related centers (green band) and bulk non-bridging oxygen hole centers (red band). Relaxation of free TP-produced excitons and energy transfer of the excitons to the surface and bulk defects will be discussed.

[a] Y. D. Glinka, S. H. Lin and Y. -T. Chen, Appl. Phys. Lett., **75**, 778 (1999).