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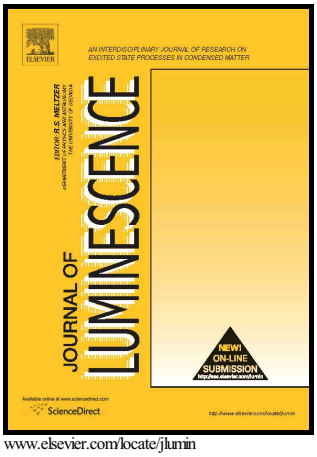

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Low-temperature photoluminescence properties of Nd-doped silicon oxide thin films containing silicon nanocrystals

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Abstract

The luminescence properties of neodymium-doped silicon oxide thin films containing silicon nanocrystals (Si-nc) were studied as a function of temperature from 10 to 300 K by steady-state and time-resolved photoluminescence (PL) spectrometry. The Nd-related emission at 920 nm, induced by the $^4F_{3/2} \rightarrow {}^4I_{9/2}$ shell transitions, was obtained either with a resonant excitation at 585 nm or with an indirect excitation at 325 nm via Si-nc, which act as sensitizers. A saturation of the neodymium-related photoluminescence intensity has been evidenced for indirect excitation thanks to silicon nanocrystals at temperatures below 100 K. According to the Förster model of energy transfer, this saturation is explained by a decrease of the coupling efficiency between Si-nc and rare earth ions at low temperatures, induced by the increase of the silicon nanocrystals lifetime at low temperatures.

Keywords : Photoluminescence, neodymium, rare earth, silicon oxide, silicon nanocrystals, low-temperature