ROLE OF OXYGEN IN RADIATIVE RECOMBINATION IN NANOCRYSTALLINE SILICON

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S u m m a r y

Oxidation of porous nanocrystalline silicon films obtained by laser ablation has been studied by infrared spectroscopy and time resolved PL. In the course of oxidation, both being aged in ambient atmosphere and as a consequence of thermal treatments, the integrated intensity of the silicon oxide IR absorption band ($Si^{-}\ O^{-}\ Si$ antisymmetric stretching at $1060\ cm^{-1}$) increases. Simultaneously, the intensity of PL increases, its spectrum shifts into the low-energy range, and its relaxation times increases from tens of nanoseconds to microseconds. On oxidation, the fraction of Si is converted into silicon oxide, whose permittivity is less than that of Si. Therefore, the value of exciton binding energy increases, and the excitonic radiation transition intensity grows. Two effects are responsible for visible PL in nc-Si: quantum-dimensional and dielectric ones.