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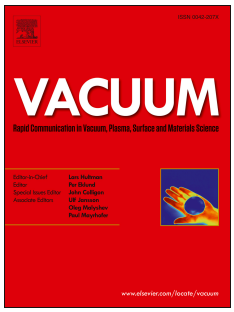

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Annealing and excitation dependent photoluminescence of silicon rich silicon nitride films with silicon quantum dots

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Silicon-rich silicon nitride (SRSN) films with different excess of silicon were prepared by plasma enhanced chemical vapor deposition (PECVD). Amorphous silicon quantum dots (Si QDs) were in-situ synthesized without annealing, while crystalline Si QDs were formed after 1100℃ annealing. The mechanisms of photoluminescence (PL) emission of samples annealed at different temperatures were investigated. The PL emission of the as-deposited samples shows little change while that of the annealed samples at 1100℃ exhibits an obvious redshift with the increase of excitation wavelength from 325 nm to 532 nm. The quantum confinement effect (QCE) in Si QDs was found to dominant the PL emission of all the as-deposited samples and the samples annealed at 1100℃. In addition, excitation energy-induced QD size selection was also found to play an significant role in the 1100℃ annealed samples with inhomogeneous size distribution of Si QDs.

Keywords: Silicon quantum dots; silicon nitride; excitation energy; photoluminescence;