Present work deals with the Si-rich silicon nitride films grown by PECVD technique on silicon substrates. The film stoichiometry was controlled via variation of NH3/SiH4 ratio from R=0.45 up to 1.0. Thermal treatment was performed at 1100°C for 30 min in nitrogen flow to form Si-NCs. To control structural and light emitting properties of the films Raman scattering, Atomic force microscope (AFM) and photoluminescence (PL) methods were used. The evolutions of PL spectra with the temperature of measurements from 20 to 300 K, as well as with the change of the excitation light quanta and excitation power densities, were studied aiming the determination of the types of optical transitions.

The PL spectra were found to be complex and the shape and magnitude of PL spectra depends on silicon nitride stoichiometry. The increase of gas ratio from R=0.45 to R=1.0 results in the shift of PL peak position from 1.5 eV up to 2.9-3.0 eV. Analysis of the temperature dependence of PL spectra revealed the presence of several PL components with the maxima at: 2.9-3.0 eV, 2.5-2.7 eV, 2.0-2.2 eV, 1.8-1.9 eV and 1.5-1.9eV. The former three PL components were detected in PL spectra of the silicon nitride films obtained at gas ratio within the range R=0.71-1.0. The peak position of the former three PL components unchanged with decreasing the temperature of measurements. This allows describing all these components to the deep defects in silicon nitride host.

The PL band with the peaks at 1.9 eV dominates in PL spectra of silicon nitride films obtained at gas ratio within the range R=0.63-0.59. The high-energy shift of this PL band with sample cooling, the correlation of the temperature dependence of PL peak with the temperature shrinking of Si band gap permits to assign the 1.5-1.9eV PL band to the exciton recombination in Si nanocrystals embedded in silicon nitride films.

In addition in PL spectra of silicon nitride films obtained at gas ratio within the range R=0.45-0.56 the new PL band 1.8-1.9eV appears. As follows from Raman scattering spectra the amorphous Si phase appears. This permits to assign the PL band 1.8-1.9eV to the optical transitions related to the Si amorphous phase.

**Keywords:** photoluminescence, SILICON NITRIDE STOICHIOMETRY, RAMAN SCATTERING

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