Raman study of light-emitting SiN_x films grown on Si by low-pressure chemical vapor deposition

F. Komarov, L. Vlasukova, I. Parkhomenko, O. Milchanin, A. Mudryi, A. Togambaeva, O. Korolik

PII: S0040-6090(15)00208-4
DOI: doi: 10.1016/j.tsf.2015.03.003
Reference: TSF 34160

To appear in: *Thin Solid Films*

Received date: 7 October 2014
Revised date: 22 February 2015
Accepted date: 2 March 2015

Please cite this article as: F. Komarov, L. Vlasukova, I. Parkhomenko, O. Milchanin, A. Mudryi, A. Togambaeva, O. Korolik, Raman study of light-emitting SiN_x films grown on Si by low-pressure chemical vapor deposition, *Thin Solid Films* (2015), doi: 10.1016/j.tsf.2015.03.003

Raman study of light-emitting SiN_x films grown on Si by low-pressure chemical vapor deposition

F. Komarov [a], L. Vlasukova [b], I. Parkhomenko [b*)], O. Milchanin [a], A. Mudryi [c], A. Togambaeva [d], O. Korolik [b]

[a] *A.N. Sevchenko Institute of Applied physics problems, Kurchatov Str. 7, 220045, Minsk, Belarus*

[b] *Belarusian State University, Nezavisimosty Ave. 4, 220030, Minsk, Belarus*

[c] *Scientific and Practical Materials Research Center, National Academy of Sciences of Belarus, P. Brovki Str. 17, 220072, Minsk, Belarus*

[d] *Al-Farabi Kazakh National University, Al-Farabiy Ave. 71, 050038, Almaty, Kazakhstan*

Corresponding author: *) Tel.: +375 17 209 59 29; fax: +375 17 212 48 33

E-mail address: irinaparkhomen@gmail.com (Irina Parkhomenko)

ABSTRACT

Si-rich silicon nitride (SRSN) films were deposited on Si wafers by low pressure chemical vapor deposition (LPCVD) technique and, subsequently, annealed at (800 – 1200) °C to form Si precipitates. The composition of SiN_x films was measured by Rutherford backscattering spectrometry (RBS). Two sets of samples differed by the amount of excessive Si (Si_{exc}) in silicon nitride were studied. Evolution of Si nanoclusters from amorphous to crystalline ones during high temperature treatment was examined by Raman scattering (RS) spectroscopy. The amorphous Si clusters were already revealed in as-deposited SiN_x while the annealing results in their crystallization. The crystalline nanoprecipitates are only registered in nitride films after annealing at 1200 °C. A dependence of Raman scattering intensity from the Si wafer on the temperature of annealing of SiN_x/Si structures was revealed. This information was used to explain the phase transformations in SRSNs during high temperature treatments. The peculiarities of photoluminescence (PL) spectra for two sets of Si-rich SiN_x films are explained