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Effect of ammonia plasma treatment on the luminescence and stability of porous silicon

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Abstract: Effect of ammonia plasma on the luminescence and stability of the porous silicon (PS) has been studied. Samples were cut into different parts to compare the as-deposited sample with the low (5 W) and high RF power (75 W) treated parts. Scanning electron microscopy (SEM) shown that the samples treated at 5 W did not demonstrate a change in the structural aspects, whereas, samples treated at 75 W shown some modifications in the final structure. Photoluminescence (PL) spectroscopy revealed strong diminishment in the luminescence as an outcome of plasma treatment for both samples. In comparison to sample treated at 5 W, high RF power treated sample did not show recovery in the PL with the course of time. Fourier transform infrared (FTIR) analysis shown the alterations in the hydrogen and oxygen bonding with time for the sample treated at 5 W. On the other hand, the appearance of stable nitrogen peaks (Si-N, N-H) were found for the other sample. PL quenching could be due to the appearance of plasma-induced defects and/or hydrogen-related dangling bonds and further shown the stability of the sample treated at 75 W (no recovery in PL) for optoelectronic applications.

Keywords: Chemical vapor deposition, Porous materials, Semiconductors, Luminescence, Nanocrystalline materials, Optical materials, and properties.

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