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PHOTOLUMINESCENCE AS A SURFACE-EFFECT IN NANOSTRUCTURES

S. Berger[a], L. Schächter[b] and S. Tamir[c]

[a] Department of Materials Engineering, [b]Department of Electrical Engineering, [c]Metal Institute; Technion - Israel Institute of Technology, Haifa 32000, Israel

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Abstract—*Nanocrystalline Si powder prepared by Laser Induced CVD (LCVD) showed photoluminescence (PL) at wavelengths of 400-900 nm when excited at 488 nm and 330 nm. The powder consists of spherical grains with an average diameter of 25 nm and log-normal size distribution. In this study we present a model which explains the origin of the photoluminescence: the latter is generated by electrons which jump from the regular bulk-states into the surface-states of the nanocrystals, which in turn are not populated after being excited by the illuminating photons. We present the effect of the surface potential on the surface states and, thus, on the possible transitions. The model is tested against experimental results which cannot be explained by the quantum size confinement effect such as photoluminescence from particles bigger than 10 nm and shift in the PL emission wavelength due to oxygen and nitrogen bonds at the surface of the particles. The tools presented here can be applied also to porous silicon.*