

ABSTRACT:

In this work, the nanocrystalline porous silicon (PS) is prepared through the simple electrochemical etching of n-type Si (1 0 0) under the illumination of a 100 W incandescent white light. SEM, AFM, Raman and PL have been used to characterize the morphological and optical properties of the PS. SEM shows uniformed circular pores with estimated sizes, which range between 100 and 500 nm. AFM shows an increase in its surface roughness (about 6 times compared to c-Si). Raman spectra of the PS show a stronger peak with FWHM=4.3 cm^{-1} and slight blueshift of 0.5 cm^{-1} compared to Si. The room temperature photoluminescence (PL) peak corresponding to red emission is observed at 639.5 nm, which is due to the nano-scaled size of silicon through the quantum confinement effect. The size of the Si nanostructures is estimated to be around 7.8 nm from a quantized state effective mass theory. Thermally untreated palladium (Pd) finger contact was deposited on the PS to form MSM photodetector. Pd/PS MSM photodetector shows lower dark (two orders of magnitude) and higher photocurrent compared to a conventional Si device. Interestingly, Pd/PS MSM photodetector exhibits 158 times higher gain compared to the conventional Si device at 2.5 V.