

## Structural, Optical and Electrical Characterization of Porous Silicon Prepared on Thin Epitaxial Layer

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Commercially available silicon-on-insulator wafers, consisting of 22  $\mu\text{m}$  thick p-type silicon epitaxial layer grown on 280  $\mu\text{m}$  thick n-type (111) silicon substrate, were electrochemically etched<sup>1</sup> in hydrofluoric acid (HF) to produce porous silicon (PSi) samples. The pores of different size and different depth were obtained by etching at different time duration, from ten to eighty minutes, using constant concentration of 48% HF in ethanol solution. The structural and the optical properties of prepared samples were investigated by FT-IR, Raman spectroscopy and scanning electron microscopy (SEM).

Current-voltage characteristics<sup>2</sup> were determined by enhancing the voltage until the current reached 100 mA, which produced 8 mA/cm<sup>2</sup> current density. Sudden increase of current, after approximately 10 minutes, was observed. That increase might be connected with the etching out of the insulator layer inside the wafer. During the remaining etching time the current was kept constant. In that period, the decrease of voltage was measured. That was explained by the decrease of resistivity caused by etching out the insulator layer.

All samples showed photoluminescence (PL) peak in the visible spectral range. The intensity of the PL peak was increased with the increase of etching time. The exception was the sample in which the whole epitaxial and insulator layers were etched out. It showed the decrease in the PL peak intensity.

There was practically no difference in recorded Raman spectra comparing with the crystal silicon (c-Si) Raman spectrum, indicating that the samples consist mostly of macroporous structures. This statement is consistent with the obtained SEM images.

The appearance of the Si-H<sub>x</sub> vibrational bands, ranging from 2000 to 2300 cm<sup>-1</sup>, observed in the FT-IR spectra, is consistent with the porous silicon etching process.

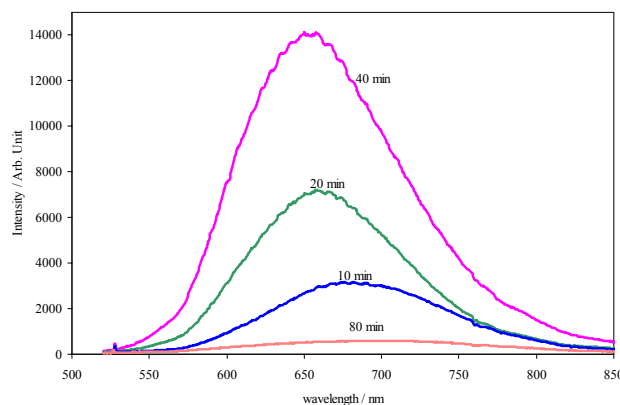


Fig. 1: The PL spectra of samples etched at different time duration

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[2] R.L. Smith, S.D. Collins, J. Appl. Phys. 71 (1992) R1-R22.