# Porous Silicon Optical Constants from Photoconduction in HF

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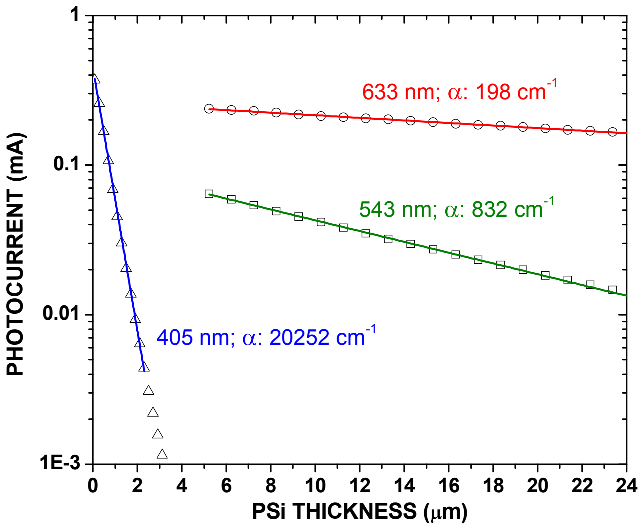
Porous silicon (PSi) is prepared by electrochemical etching of silicon substrates in hydrofluoric acid (HF). It is an attractive silicon nanostructure for optoelectronics, photovoltaics, medicine and sensing. For some applications such as optical sensing or photonics, the knowledge of PSi optical constants is necessary. Most methods used to determine the optical constants of PSi use dried samples, sophisticated setups, and meticulous sample preparation, which may alter PSi structure. Here, we show that the optical constants of PSi can be measured using in-situ photoconduction of PSi in HF during PSi formation. The liquid-PSi-Si substrate junction was illuminated from the liquid side and reverse biased, allowing the observation of a photocurrent. As only the charge carriers photogenerated in the Si substrate contribute to the photocurrent, the measured photocurrent is proportional to the optical transmission through PSi. The absorption coefficient and the refractive index can be obtained by fitting photocurrent-PSi thickness curves, as shown in the figures below. This technique has several advantages over conventional ones. No particularly sophisticated sample preparation or handling is necessary, no high-precision optical instruments are necessary, while still preserving a very good structural state of PSi layers, even for high porosities and for arbitrary layer thicknesses. Moreover, only one sample, in a single experiment, is sufficient for the determination of the optical constants at selected wavelengths [1].

[1] B. Gelloz et al. ECS Journal of Solid State Science and Technology, *in press*




Figures: photocurrent versus PSi thickness for a porosity of 62% and indicated illumination wavelengths. Left: using thick layers, absorption coefficient $\alpha$ can be obtained with high accuracy. Right: Thin layers allow interference observation and determination of both optical constants $\alpha$ and $n$, the latter with high accuracy.