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Porosity percentage effect on porous silicon optical absorption

An analysis of the reflectance spectra in porous silicon samples is reported to determine the effect of the percentage of porosity on their optical absorption capacity in the visible spectrum. Porous silicon (PS) samples were prepared by electrochemical anodization at 5, 10, 15, 20 and 30 minutes. A crystalline silicon (CS) wafer with orientation (100), phosphorus-doped n-type (thickness: 500 ± 15 μm), and resistivity of 1-5 Ωcm was used. A constant current density of 40 mA/cm2 and a 40% hydrofluoric acid (HF) solution were used in all cases. To measure the reflectance, an EDINBURGH INSTRUMENTS FS5 spectrofluorimeter was used as an optical energy source, which has a 150 W ozone-free xenon arc lamp and an excitation spectral coverage of 230 nm - 1000 nm and an R928P Photomultiplier, with spectral coverage of 200 nm - 870 nm, cooled and stabilized. Measurements were set in a range from 200 to 800 nm. The percentage of porosity changes significantly with anodization time, with an approximately linear increase as a function of the thickness fraction of the porous layer. The reflectance decreases noticeably for the PS samples, even for low anodization times, and reduces more for higher anodization times. From the reflectance results, the absorbance of each sample was obtained, showing a significant dependence on the percentage of porosity.

Keywords

Porous silicon, porosity, reflectance, optical absorption.

Reference

Nogal, U., (Master Thesis) Estudio de las Propiedades Ópticas y Térmicas en Silicio Poroso Elaborado Mediante Ataque Electroquímico, Mexico, (2012).

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