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STUDY OF THE MORPHOLOGY, THERMAL AND OPTICAL PROPERTIES OF N-TYPE POROUS SILICON SAMPLES FABRICATED USING SHORT ELECTROCHEMICAL ETCHING TIMES.

The study of porous silicon has gained prominence due to modifications in its thermal and optical properties stemming from the formation of a porous layer, expanding its applications from sensors development to solar energy conversion systems design. One of the most commonly employed techniques for its fabrication is electrochemical etching; where a mayor challenge lies in achieving uniformity in pore distribution and size. In this investigation, porous silicon samples were fabricated via electrochemical etching on N-type crystalline silicon substrates, utilizing hydrofluoric acid (40 %) and platinum plates. The samples were processed from 1 up to 10 minutes, studying the etched surface morphology, along optical and thermal properties of the samples, aiming to establishes a correlation between the etching conditions and the observed physical properties. The morphology of the etched surface was analyzed using scanning electron microscopy, evaluating the distribution of pore size in all samples. The optical characterization of samples was focused on the examination of absorption and reflection spectra, as well as photoluminescent response; while the effective thermal properties have been determined from the analysis of the thermal response, obtained through time-resolved infrared photothermal radiometry and frequency-resolved photoacoustic detection technique. Upon prolonging the electrochemical etching time, an increase in pore area of up to 39.5% was observed. This led to a shift in the luminescence spectrum from 800 nm to 550 nm, alongside an increase in absorbance and a reduction in effective thermal diffusivity of up to 35.5%. These alterations were attributed to the increased incidence area and the formation of a SiO2 layer with Si nanoparticles. These modifications open new perspectives for their application in LED devices.

Keywords

Porous silicon; Electrochemical etching; Morphology; Photoluminescence; Thermal diffusivity.

Reference

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