PORE WIDENING BY OXIDATION/DEOXIDATION PROCESSES ON POROUS SILICON

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Several applications of porous silicon (PSi) like photonics, renewable energy and biological sensing \cite{1}, acquire a more interesting approach when different material is infiltrated into the pores. These materials can be metals, dielectrics, semiconductors or even biomolecules, and their physical and chemical properties could be influenced by confinement effect, for example \cite{2}. Although the pore diameter in PSi can be controlled basically by HF concentration in the electrolyte and the resistivity of the Si wafer substrate, sometimes it is necessary to have a precise increase of pore diameter which can be dependent on the application. In this work, we study a fine control of pore diameter by a sequence of oxidation and deoxidation processes of PSi samples in the mesoporous range. For this process, we take advantage of the irreversibility of thermal oxidation at the PSi surface and the fact that a HF solution removes efficiently the formed SiO\textsubscript{2} layer. For samples with different number of oxidation/deoxidation stages, we compare the refractive index calculated value based on models develop in \cite{3}\cite{4} using SEM images and those calculated by FFT \cite{2} of reflectance spectra. We analyzed the process as a function of temperature of thermal oxidation and the HF solution concentration in deoxidation step. We found that it is possible to duplicate the pore diameter and the refractive index value varying from 2.28 to 1.3. Acknowledgements: This work was partially supported by PROMEP (SEP-Mexico) and DGPI-BUAP (Mexico).

\textbf{Keywords}: Porous silicon, Thermal oxidation, Refractive index

\textbf{References}:

\cite{1} P. Granitzer, K. Rumpf. Materials \textbf{3} (2010) 943.

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