## Porous Silicon Science and Technology

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When a silicon wafer is subjected to the electrochemical etching in fluoride-based solution, silicon surface develops pores. Such kind of porous structure is often called porous silicon. A variety of pore sizes ranging from a few nanometers up to a few micrometers can be obtained during the etching process, depending on different operating parameters including the concentration of HF in the electrolyte, the magnitude of current flowing through the electrochemical cell, the presence of a surfactant, type and density of silicon dopants, etching time, and illumination process. The porosity of the produced porous silicon layer can be controlled and modulated by adjusting the applied current. It is a fact that porous silicon has attracted increasing interest from the view point of both basic research and technological applications due to mainly its promising features, luminescence properties and the high specific surface area to volume ratio. The scope of applications includes microelectromechanical systems (MEMS), silicon on insulator (SOI), photovoltaic conversion, sensing applications (gas, humidity and biosensors), biotechnology, surface micromachining, waveguides, templates for nanofabrication and many others.

This presentation will give an overview of research being done by our group in the area of silicon nanotechnology. The presentation will discuss some of the practical issues and challenges with micro and nanofabrication based on silicon.
We show that various arrays of nanopores with different morphologies can be created in silicon by a simple electrochemical technique. The use of as-formed porous silicon as a template for the fabrication of copper microrods and nickel microtubes are also demonstrated. Furthermore, the fabrication of photonic crystals in silicon and utilizing the material for the sensing of chemical vapors will be briefly described. Finally, the electrochemical oxidative polymerization of conducting polymers into regularly nanostructured porous silicon will be shown. Results of the characterization of the obtained nano-systems based on silicon will be presented and thoroughly discussed.