Porous Aluminum Oxide as a Sensor-fabricating Template - M. Moskovits, A. Kolmakov, Y. Zhang, and A. Morrill (University of California Santa Barbara)

Porous anodic aluminum oxide (PAO) has been known for half a century or more. It's use as a template in which to grow metal or semiconductor nanowires and other nanostructures, magnetic materials and catalysts goes back to the 1970s. Due largely to the work of Masuda, rapid techniques are now available to produce highly-ordered PAO and with it, large, highly-ordered arrays of nanostructures. Because the diameter and lengths of the pores in PAO can be manipulated over a significant size range this technique offers a powerful strategy for fabricating nanowires of variable dimensions that can be used to construct either single-nanowire, or more uniquely, nanowire-array-based devices. Semiconductor nanowires and nanotubes have shown remarkable electronic and optoelectronic properties when configured either as simple current/voltage impedance elements or as field-effect transistors. Their very high surface to volume ratio makes them ideal sensors in situations where the gaseous species adsorbing on their surface donate or extract charge, in turn affecting the nanowire's conductivity. By reversing the process, nanowires configured as FETs potentially allow the surface chemistry, and hence the catalytic properties of the nanowire, to be tuned using the gate voltage as a kind of chemical-potential-setting parameter. An exciting goal is to use functionalized single-nanowire FETs or devices based on nanowire arrays as systems on whose surface not only the rate and extent of a catalytic reaction but also its selectivity can be varied entirely by varying the voltages applied to the device's terminals. Our recent progress towards those goals will be presented.