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Nanoscale Patterning of Electrochemically Deposited Metallic Features on Si, Ge, InP and GaAs Surfaces[1]

JILLIAN BURIAK, Dept. of Chemistry, University of Alberta and the National Institute for Nanotechnology, National Research Council, Edmonton, Canada

Nanostructured materials continue to be the focus of intense research due to their promise of innumerable practical applications as well as advancing the fundamental understanding of these intriguing materials. In particular, the need for metallic features of increasingly smaller size regimes has imposed stringent demands upon chemists to produce a variety of highly functional materials with reduced dimensions.While much effort has been expended towards the synthesis of nanoscale structures, one of the most challenging aspects for the nanoscale materials community is the question of how to 'wire in' these functional elements with the real world. In this talk, we will describe recent work towards the synthesis and nanoscale patterning of metallic structures on semiconductor surfaces such as silicon, germanium, gallium arsenide and indium phosphide. Through simple and efficient galvanic displacement reactions on these interfaces, complex metal nanostructures form spontaneously, and can be patterning via self-assembling soft block copolymer materials. The self-assembled materials direct transport of reagents to the semiconductor so that the reaction takes place in a spatially defined manner, with precise control over the quantity of reagent delivered. Even mixtures of reagents can be 'sorted out' by these interfaces to produce nanoscale ($\sim$10 nm) domains of different chemical functionalities, simultaneously. We will describe these and related approaches towards precise patterning of semiconductor surfaces, entirely via wet-chemical processes that are compatible with existing fabrication strategies.

[1]In collaboration with Masato Aizawa, Department of Chemistry, University of Alberta and the National Institute for Nanotechnology, National Research Council.