**319c Fabrication of Arrays of Position-Controlled, Individually Seeded, Aligned, Electrically Addressable Si Nanowires**

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One-dimensional nanostructures such as carbon nanotubes and semiconductor nanowires have attracted increasing attention in recent years due to their unique physical properties and potential applications in electronics, photonics and life science. Silicon nanowires (SiNWs) are an especially promising candidate for developing bio/chemical sensors and high-speed field effect transistors because of their several appealing properties including the following: (i) the electrical properties of SiNWs can be tuned by controlling NW diameter and the dopant type and concentration, (ii) the modification of surfaces for the preparation of interfaces having superior electronic characteristics and selective for binding various analytes of interest, are well established, and (iii) the integration with microfluidic channels and CMOS driver circuits can be achieved within the same material platform. Although individual nanodevices based on SiNWs have been demonstrated, methods that can enable assembly and integration of these building blocks into various device architectures over large areas in a controlled manner need to be developed further in order to realize their full potential in a wide range of applications.

In this presentation, we demonstrate the fabrication of large-scale arrays of individually seeded, electrically addressable SiNWs with controlled dimension, placement, and orientation by utilizing both bottom-up and top-down approaches. The fabrication process starts with the formation of uniform arrays of Au catalyst nanoparticles on oxidized Si substrates using electron beam lithography (EBL) and subsequent evaporation of Au and lift-off. The growth of SiNWs was carried out at temperatures between 450 and 550 ºC using disilane (Si2H6) as a precursor via the vapor-liquid-solid growth mechanism. High-resolution TEM measurements show that SiNWs are single-crystalline and of high quality. A single SiNW was successfully grown from each lithographically defined catalyst site in the array. The diameter, position and density of SiNWs can be controlled to create desired arrays through lithographic means. The as-grown SiNWs on the SiO2 surface were randomly oriented and ion beam irradiation was employed to align the SiNWs to desired direction. Lastly, electrical contacts to the ends of SiNWs were made by defining pairs of electrodes using EBL and subsequent evaporation of contact metal and lift-off. This method of fabricating arrays of SiNWs with control over NW location, density, diameter, and orientation could provide a pathway to a manufacturable approach to assembly and integration of NWs into complex device systems.