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“Post-Growth Surface Doping of Silicon Nanostructures”

Abstract: Control over dopant distributions for nanostructure-scale semiconducting building blocks is key for a large range of applications. Formation of sharp junctions and localized dopant profiles is both challenging and required in the context of recent top-down device architectures and for bottom-up based semiconducting building blocks devices such as nanowire-based transistors and sensors. However, achieving the required control of dopant distributions and selectivity at the nanometer scale is challenging. Recently, we introduced a new doping method, monolayer contact doping (MLCD), as a simple method for surface doping with nanometer-scale control. MLCD results in the formation of highly controlled, ultra-shallow and sharp doping profiles. The dopant source used is a monolayer containing potential dopant atoms formed on a substrate, separate from the semiconductor structure intended for doping. Since MLCD relies on the surface chemistry, fine control of surface details and interactions at the semiconductor interface during the thermal anneal and diffusion are key. Doping levels are controlled by the molecular details of the donor monolayer, details of the interface such as native or thermal oxide layers, and annealing conditions. Recent results obtained by MLCD will be presented and the surface chemistry details will be discussed. Surface doping as well as direct dopant patterning capabilities will be presented and discussed.

Biography: Dr. Roie Yerushalmi joined the Institute of Chemistry, of the Hebrew University of Jerusalem, in October 2008. Roie is a member of the Harvey M. Krueger Center for Nanoscience and Nanotechnology. During his post-doctoral studies at UC Berkeley, Roie entered the field of nanoscience and focused on the study of nanometric scale systems with an emphasis on nanostructure synthesis, characterization and assembly. Roie took part in developing new methods for the formation of large-scale ordered nanowire arrays, deployment of nanostructures at interfaces, and surface doping of nanostructures. His current research interests are related to the design and synthesis of hybrid nanostructures for photocatalysis and for the harvesting of light energy for renewable and sustainable energy source. The research activities in his group extend from the development of new surface chemistries, the synthesis and surface modification of hybrid nanostructures, nanostructure array assembly, and comprehensive characterization of complex nanostructured systems by application of analytical methods. Roie is the recipient of several prizes including the Kennedy prize and the career development award by the Human Frontier Science Program. Roie received the prestigious ERC young scientist research grant for developing large scale architectures with nanometric structured interfaces for charge separation, transport, and interception. He was recently appointed a fellow of the Israeli Young Academy, a newly formed organization for the advancement of young scientists and science, created by the prestigious Israeli Academy of Sciences and Humanities.