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Electrokinetic method to study the surface and electronic properties of silicon nanowire diodes MINH THANG HOANG, Rutgers University, New Brunswick, AMAR MOHABIR, AMY BRUMMER, Georgia Institute of Technology, LEONARD FELDMAN, Rutgers University, New Brunswick, MICHEAL FILLER, Georgia Institute of Technology, JERRY SHAN, Rutgers University, New Brunswick — Colloidal dispersions of nanoelectronic devices offer many new opportunities to develop self-propelled nanomachines and advanced nanosystems. A better understanding of their surface and electronics properties, and how they may vary statistically within a sample and as a function of processing, is needed for nanodevice manipulation and assembly. In this study, we demonstrate efficient electrokinetic methods to characterize VLS grown silicon nanowire diodes. In comparison to a homogeneous nanowire, a nanowire diode has a specific rotational direction under an external applied DC electric field, due to its permanent dipole. Contrary to previous work that has assigned this permanent dipole to opposite charges at the junction of n- and p- regions, we show that the dipole is formed due to a non-uniform surface charge distribution. In addition, the nanowire diode, when powered by an external AC electric field, will have a rectified motion that depends on the orientation of the permanent dipole, with a field strength velocity that is dependent on the built-in voltage. These electrokinetic methods, capable of ensemble sample analyses, offer a new approach to efficiently determining the surface and electronic properties of p-n nanowires. The approach represents a crucial step toward the manipulation and separation of complete nanoelectronics devices.

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