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Solution-Based Electro-Orientation Spectroscopy (EOS) for Contactless Measurement of Semiconductor Nanowires[1] WUHAN YUAN, Rutgers University, AMAR MOHABIR, GOZDE TUTUNCUOGLU, MICHAEL FILLER, Georgia Tech, LEONARD FELDMAN, JERRY SHAN, Rutgers University — Solution-based, contactless methods for determining the electrical conductivity of nanowires and nanotubes have unique advantages over conventional techniques in terms of high throughput and compatibility with further solution-based processing and assembly methods. Here, we describe the solution-based electro-orientation spectroscopy (EOS) method, in which nanowire conductivity is measured from the AC-electric-field-induced alignment rate of the nanowire in a suspending fluid. The particle conductivity is determined from the measured crossover frequency between conductivity-dominated, low-frequency alignment to the permittivity-dominated, high-frequency regime. We discuss the extension of the EOS measurement range by an order-of-magnitude, taking advantage of the high dielectric constant of deionized water. With water and other fluids, we demonstrate that EOS can quantitatively characterize the electrical conductivities of nanowires over a 7-order-of-magnitude range, 10^{-5} to 10^{2} S/m. We highlight the efficiency and utility of EOS for nanomaterial characterization by statistically characterizing the variability of semiconductor nanowires of the same nominal composition, and studying the connection between synthesis parameters and properties.

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