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Self-assembly and electrostatic interactions of carbon nanotubes in nonpolar dielectric liquids LUCIANA OLIVEIRA, RAMAKRISHNA PODILA, Clemson University, JAY GAILLARD, STEVEN SERKIZ, Savannah River National Laboratory, APPARAO RAO, Clemson University, SAVANNAH RIVER NATIONAL LABORATORY COLLABORATION — We report on the self-assembly of carbon nanotubes (CNTs) in nonpolar dielectric liquids under the influence of DC-generated electric fields. This process gives rise to electrostatic and hydrodynamic interactions of the CNTs in insulating nonpolar solvents. While some studies of the self-assembly of carbon nanotubes in response to a DC-field have been carried out in conductive solvents, the analysis of the self-assembly process is complicated by the current flow temporally affecting the particle charge and an assembly timescale of tenths to hundredths of seconds. In contrast, experiments in insulating liquids allow for the investigation of self-assembly processes where: the particle charge is not expected to change as a function of time and at a timescale of seconds this allows for an investigation of the transient states of the assembly process. In the presence of an electric-field, CNTs present in the solution experience an electrophoretic force due to their surface charges. When a DC field is applied across the electrodes, CNT bundles move according to their electrophoretic mobility. We find that the threshold voltage, above which the insulator-to-conductor transition occurs, varies sensitively as a function of zeta potential and hydrodynamic particle size. In addition, a percolation power law supports the observed threshold voltage as a function of CNT concentration and zeta potential.

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