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Aggregation and electrorheology in nanotube suspensions under applied electric field AMIR FARAJIAN, Rice University, OLGA PUPYSHEVA, HOWARD SCHMIDT, BORIS YAKOBSON — We consider the electrostatic response, i.e., polarization, mutual interactions and aggregation, of the nanotubes in solution under applied electric field. We model the nanotubes as rigid cylindrical rods with hemispherical ends. The surface charge densities of the nanotubes are obtained by solving an integral equation numerically. The calculated charge densities are then used to derive the interaction energies of the nanotubes with the applied field, as well as among each other. In addition to the electrostatic response, this would be a reasonable estimate of the radio-frequency (RF) electrodynamic response, as the RF wavelength is typically much larger than the nanotubes lengths. Our results show that nanotubes alignment with the electric field is very sensitive to their diameter. Nanotubes with larger diameters, e.g. multiwall or bundles, can overcome Brownian aggitation of the solvent molecules more effectively. The semiconducting nanotubes response is around two orders of magnitude lower than that of the metallic ones. The response is also proportional to the square of the applied field. The conditions for chain-like aggregation of the nanotubes are also explored using our results. We find that the calculated rupturing forces provide an estimate for the yield stress, which is in qualitative agreement with experimental results.

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