MODELING DIELECTROPHORETIC ASSEMBLY OF NANOWIRES

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Nanowire (NW) assembly is currently of great interest, in part because NWs are considered as a fundamental component in the fabrication of a variety of nanoelectronic devices [1-3]. We have developed the immersed electrohydrodynamics finite element method (IEFEM) for modeling the electrohydrodynamics of NWs. The three-dimensional dielectrophoretic (DEP) assembly of NWs across opposing micro-electrodes was, for the first time, comprehensively studied using this new method. It is found that the DEP force reaches a maximum when the ratio of gap size to NW length is in the range 0.85 to 1.0. Both magnitude and sign of the DEP torque on each NW varies with this ratio, and also with the orientation angle and the geometry and configuration of the electrode. The simulation of the dynamic assembly of individual and bundled NWs agrees well with experiment. This method is of sufficient power that it will be of direct use in modeling DEP-based assembly and thus the manufacturing of nanoelectronic devices.

References

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