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Chaining of Dielectrophoretic Suspensions under Simple Shear

HOWARD HU, T.N. SWAMINATHAN, University of Pennsylvania — Polarizable particles in suspensions are known to form chains when subjected to an electric field. A finite element based numerical method to evaluate the dielectrophoretic forces between particles, using the Maxwell's Stress Tensor method, has been implemented. This method is known to provide more accurate dielectrophoretic forces between the particles when compared with the traditional dipole moment approximations, especially when the interparticle gaps are small. The difference of the predicted dielectrophoretic force between two particles from our numerical solution and from the dipole moment approximation is observed to increase as the gap between them decreases. Numerical simulations demonstrate the formation of chains in a dielectrophoretic suspension under the action of an electric field. When this suspension is under simple shear, the chain tends to deform and eventually break. The final length of the chains is a function of the Mason number, which is the ratio of the viscous forces to the electrical forces experienced by the particles in the suspension. The dependence of this length on the Mason number has been determined from numerical simulations and compared with traditional analytical chain models.

T. N. Swaminathan
University of Pennsylvania

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