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Direct Numerical Simulations of Electric Field Driven Hierarchical Self-assembly in Mixtures of Particles[1] S. B. PILLAPAKKAM, Associate Professor, SUCHANDRA DAS, Student, EDISON AMAH, Research Engineer, IAN FISCHERQ, PUSHPENDRA SINGH, Professor — We have numerically studied the process of self-assembly in particle mixtures when they are subjected to an externally applied electric field. The inter-particle electric forces cause mixtures of micron to nano sized particles to self-assemble into molecular-like hierarchical arrangements consisting of composite particles which are organized in a pattern. As in experiments for micron sized particles, the structure of a composite particle depends on factors such as the relative sizes and the number ratio of the particles, their polarizabilities, and the electric field intensity. The minimum electric field intensity required for manipulation is larger for nanoparticles for which the electric field induced lateral forces must also overcome Brownian forces. Also, for nanoparticles, the composition of composite particles was relatively more uniform because of the mixing induced by Brownian motion. Particles of mixtures containing only positively or negatively polarizable particles arrange in chains and columns which become aligned in the electric field direction, but when both type of particles are present they come together to form clusters.

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