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Classical dynamics simulations on pattern formation by metallic spheres with induced electrostatic interactions PETER FLECK, ALFRED HUBLER, Center for Complex Systems Research, University of Illinois at Urbana-Champaign — We study classical dynamics simulations of metallic spheres immersed in a highly viscous, but weakly conducting medium while exposed to the electrostatic field of external electrodes of various geometries. We represent the system's charge dynamics by the spheres' multipole moments as induced by the electrodes. We simulate the sphere dynamics for various particle numbers retaining force contributions up to dipole-dipole order. Besides the electrodes' location and the spheres' initial positions, we find the system's dynamics to be governed by the ratio of a spheres motion time scale and a charge dynamics time scale alone. We find the spheres to form line arrangements between opposing electrodes for an important region of parameter space. We determine the phase boundaries of this line formation behavior in the sphere dynamics simulations. We find the phase diagram to be in good agreement with analytical predictions.

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