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Size-dependent scaling and ordering in nanoparticle island self-assembly[1] JACQUES AMAR, CHAKRA JOSHI, YUNSIC SHIM, TERRY BIGIONI, University of Toledo — While there are a number of similarities between nanoparticle (NP) island self-assembly at a liquid-air interface during drop-drying and epitaxial growth there are also some important differences. Here we present experimental results for the dependence of the island density, island-size distribution, and capture-zone distribution on coverage, deposition flux, and NP diameter which we then compare with epitaxial growth models. Our results indicate that, due to the increase in the strength of the short-range attraction between NPs with increasing NP size, the critical island-size decreases with increasing NP size. However, we also find deviations from epitaxial growth models for small NPs which indicate that additional effects may play a role. We also present results for the ordering of large NP islands which indicate the existence of long-range repulsive interactions. One possible mechanism for such an interaction is the existence of a small net dipole moment on each NP which occurs as a result of an asymmetry in the distribution of attached thiols. Consistent with this mechanism, we find good agreement between experimental results for the nearest-neighbor distribution between islands and simulations which include dipole repulsion.

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