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A theoretical study of the phase behavior of spherical colloids decorated with adhesive domains HOMIN SHIN, KENNETH SCHWEIZER, University of Illinois at Urbana-Champaign — We propose a nonlinear self-consistent phonon theory for the self-assembly of spherical particles with patterned adhesive surfaces, such as Janus colloids. The approach is first tested against the known crystallization behavior of hard spheres, and also homogeneous particles that interact via short range attractions. Janus colloid pair interactions are described by an anisotropic extension of the Baxter adhesive sphere potential where particles attract only if their hydrophobic domains are in contact. Given various crystalline symmetries, the effective harmonic potential experienced by a colloid confined to its Wigner-Seitz cell is self-consistently computed. The characteristic vibrational displacements or localization lengths are determined by the lattice symmetry as well as the strength and surface pattern of adhesive interactions. The crystal free energy is then computed, and thermodynamic stability evaluated, including pressure-driven solid-solid transitions, and the fluid-solid coexistence boundary based on the Baxter solution of the Percus-Yevick integral equation for adhesive hard sphere liquids. A primary goal is to evaluate the influence of patch size, attraction strength, and geometric patterning on the formation of heterogeneous crystalline phases.

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