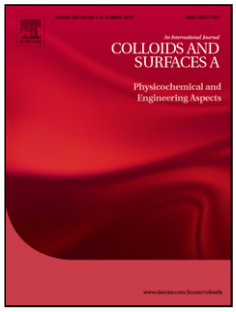

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Two-stage kinetic phase transition in a platelet-colloid mixture

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A theoretical scheme that combines thesemi-grandcanonical ensemble theory amended with the scaled particle theory, the fundamental measure DFT theory, and the free energy minimization methodwas used to study phase coexistence of platelet-colloid mixture.

Influence of depletion effects on the phase separation behavior were examined and demonstrated by comparing disc-colloid and platelet-colloid mixtures.

Gas-liquid-solid triphasiccoexistence is interpreted as a coalescenceof two sets of two coexisting phases.

Predicted partial volumes of the three coexisting phases are reminiscentofthose experimentally reported polymer-colloid mixture.

The semi-grand canonical ensemble theory augmented by the free volume approximation and the scaled particle theory was applied to construct the Helmholtz free energy density function f of a mixture of uncharged colloidal hard spheres and a depletion agent of colloidal hard platelets. The episode of the phase-separation phenomenon is then described by a composite f_m which is written as a sum of the coexisting free energy densities f_i (i =gas, liquid or solid) and the latter is weighted by V_i/V, V_i and V being the ith spatial volume and total volume, respectively. In this work, we applied the free energy density minimization method to f_m [G.F. Wang and S.K. Lai, Phys. Rev. E 70 (2004) 051402] and calculated the domains of phases in coexistence instead of delineating coexisting phase-diagram boundaries obtained by computing the pressure and chemical potential in the conventional thermodynamic equilibrium condition. The calculated coexistence domains thus have the same patterns as many colloidal laboratory experiments. We obtained in our calculated platelet-colloid phase diagram the well-known triangular area of triple-phases coexistence. This area, however, has to be realized as some kind of a kinetic process showing coalescence of two sets of coexisting