Two- and three-phase equilibria of polydisperse colloidal mixtures in bulk and random porous media

T. Hvozd and Yu. Kalyuzhnyi

Institute for Condensed Matter Physics of the National Academy of Sciences of Ukraine, 1 Svientsitskii Str., 79011 Lviv, Ukraine,
E–mail: tarashvozd@icmp.lviv.ua

We have studied the phase behavior of colloidal system, which is represented by polydisperse hard sphere Yukawa mixture in bulk [1] and random porous media [2] using extension and combination of high temperature approximation and scaled particle theory. The porous media are represented by the matrix of randomly placed hard-sphere obstacles. We have extended and applied the scheme developed to calculate the phase diagrams of polydisperse mixtures described by the truncatable free energy models, i.e., the models with Helmholtz free energy defined by the finite number of the moments of the species distribution function [3]. Due to the confinement, polydispersity effects are substantially enhanced [2]. At an intermediate degree of fluid polydispersity and low density of the matrix, we observe two-phase coexistence with two critical points, and cloud and shadow curves forming closed loops of ellipsoidal shape. With the increase of the matrix density and the constant degree of polydispersity, these two critical points merge and disappear, and at lower temperatures the system fractionates into three coexisting phases. A similar phase behavior was observed in the absence of the porous media caused, however, by the increase of the polydispersity [1,4].

1. T. V. Hvozd and Yu. V. Kalyuzhnyi, Condens. Matter Phys., 2016, 19, 23603.
2. T. V. Hvozd and Yu. V. Kalyuzhnyi, Soft Matter, 2017, 13, 1405.
3. L. Bellier-Castella, H. Xu and M. Baus, *J. Chem. Phys.*, 2000, **113**, 8337–8347.
4. T. V. Hvozd and Yu. V. Kalyuzhnyi, Condens. Matter Phys., 2015, 18, 13605.