Modeling Order–Disorder Boundaries of Colloidal Dispersions in Organic Solvents on the Basis of Force Measurements

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Soft colloidal crystals are ordered arrays composed of colloidal particles suspended in solvents with certain interparticle distances. Although their formation needs to be controlled over a wide variety of solvents for their possible applications, the physical factor determining the order–disorder transition of colloidal dispersions has not yet been clarified. Here, to evaluate the interaction force at the order–disorder boundaries, we combined the fabrication of soft colloidal crystals and the measurement of interaction forces between particles using a series of monohydric alcohols as dispersion media. We found that the interparticle forces at the boundaries show the universal threshold independent of the kind of solvents including alcohols and water. Furthermore, this boundary force was demonstrated to be calculated *a priori* by referring to the boundary pressure in the Alder transition which is the liquid-to-solid transition in a hard sphere system, leading to the prediction of the boundary volume fraction as long as an interaction force profile is available. Our proposed model will provide a general guideline for the formation of soft colloidal crystals in various solvents.