

박막의 증발 중 나타나는 이원 혼합물의 자가 분리에 미치는 유체 흐름의 영향

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Self-segregation in a drying thin film of binary colloidal mixtures: a hydrodynamic flow effect

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Key Words: Self-segregation(자가 분리), Evaporation of a Thin Film(박막 증발), Colloidal Mixtures(혼합 콜로이드 입자)

Evaporation of a liquid thin film containing colloidal binary mixtures is known to induce the size-dependent separation in the vertical direction. The segregation occurs depending on the different time scales of particle transport mechanisms such as diffusion and osmotic pressure. Although the processes of the self-organization have recently been explained in experiments and simulations, the effect of an evaporation-induced hydrodynamic flow is excluded in most of analyses and the extent to which the hydrodynamic flows drive the particle segregation is remained unclear. During evaporation, the convective flow in a thin film redistributes particles both in the horizontal and vertical directions. It may promote or demote the vertical separation of particles, depending on the direction and relative strength of the flow. Here, we develop a Monte Carlo method to quantitatively study the effect of an internal hydrodynamic flow on the self-stratification of colloidal mixtures. The method will provide an insight to control final coating profiles in which a flat contour is for many situations desirable.