（様式５）

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学　位　（　博　士　）　論　文　要　旨
(Doctoral thesis abstract)

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<tr><td>論文題目
Title</td><td colspan="5">(和文) 水の蒸発による圧縮下での粒子充填および界面変形
(英文) Packing of particles and deformation of interfaces under compression induced by water evaporation</td></tr>
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論文要旨（和文要旨(2000 字程度)または英文要旨(500words)）
※欧文・和文どちらでもよい。但し、和文の場合は英訳を付すこと。
Write a summary in Japanese (2000 characters) or in English (500words).
If the abstract is written in Japanese, needed to translate into English.

Solid particles can be dispersed in a liquid phase or adsorb at a liquid-liquid interface. This feature is utilized to produce various functional materials. Drying of suspensions or particle-stabilized emulsions is one of the easiest way to obtain these materials. Hence I focused on drying process of colloidal dispersions, such as suspensions or particle-stabilized emulsions, and resulting morphological changes in these liquids. This thesis consists of six chapters. In the first chapter, I highlighted importance of fundamental insights on drying of colloidal dispersions and its promising applications to industrial technologies. Chapter 2 and 3 focus on film formation process owing to drying of suspensions in which solid particles are dispersed in water. In the following chapter, chapter 4 and 5, I discuss shrinkage and compression of particle-stabilized droplets induced by drying.

In chapter 2, I evaluated drying fluxes of suspensions confined in narrow channels with various combinations of height and width, which determined drying interfacial area. It was clearly revealed that the smallest scale in the interface was the most sensitive to the drying fluxes. In addition, there were a threshold drying flux for the dispersed particles to form a packed film, which was well explained by a simple mathematical model based on the conservation of the particles during drying.

In chapter 3, morphological change in particulate film owing to drying in the narrow channels was investigated. Drying interfaces were set to be tilted with an angles of θ_0 to a bulk flow direction of the suspensions. As drying proceeded, the packing front between the film and the suspension became vertical to the bulk flow direction. I observed that a part of advected particles was transported to bottom of the packing front, which would cause a faster growth rate of the packed film at the bottom in the channel than the top. A mathematical model on the basis of the conservation of the particles in the channel during drying could well describe time-lapses of the morphological change in the packed film.

In chapter 4, I investigated drying kinetics of particle-stabilized water droplets in an oil layers. Morphological change during drying of the particle-stabilized droplets, that is, buckling or spherical shrinkage could be controlled by wettability of the particles adsorbed on an oil-water interface. When the thickness of the oil layer is smaller than the droplet diameter, the buckled droplets showed faster drying rate than the spherically shrinking droplets. This result could be quantitatively explained by simple mathematical models which took into account difference in the effective water-oil interfacial areas between both types of shrinking. Hence buckling could enhance the drying rates of the dispersed droplets in the thin layer of

continuous phase.

In chapter 5, the effects of ion concentration on response to drying-induced compression of particle-stabilized droplets were investigated. Drying of the continuous water phase induces the dispersed droplets to be compressed, which leads to deformation and coalescence of the droplets. At low ion concentrations, the droplets were deformed into polygonal shapes before coalescing in the final stage of water drying. This indicates that oil-water interfaces are liquid-like. Conversely at high ion concentrations, they coalesced more readily into non-spherical shapes. In this state, the stabilizing particles were observed to be aggregated on the oil-water interfaces, which formed solid-like particulate shell layers on the droplets. Thus these results suggested that the oil-water interfaces exhibited both liquid-like and solid-like responses to drying-induced compression, depending on ion concentrations.

In the last chapter, chapter 6, I summarized contents of chapter 1 – 5 and described concluding comments.

（英訳）※和文要旨の場合(300 words)

If the abstract is written in Japanese, needed to translate into English.(300 words)