

# Effect of Drying Conditions on Particle Distribution in Coatings

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Coatings prepared from particulate slurries or suspensions are used to provide properties to a variety of products. In a production process, drying directly influences performance because particle distribution through the coating thickness is affected by drying conditions. However, control of the particle distribution in systems that contain more than one type or size of particle, and especially the effects of drying conditions on particle distributions, have yet to be explored in detail. To elucidate particle distribution mechanisms, here we study the effect of drying conditions and slurry composition on the particle distribution in a simple model system. In this study, the slurry contains two types of silica particles (300nm & 1 $\mu$ m), polyvinyl alcohol binder and water and I prepared a low viscosity slurry and a high viscosity slurry.

First, I observed cross-section of final dried coatings. In a low viscosity slurry and low drying rate case, we found that small particles segregate between surface and center of coatings (Fig.1). In a low viscosity slurry and high drying rate case, small particles segregate at surface significantly (Fig.2). In a high viscosity slurry case, both particles distribute uniformly in coatings (Fig.3,4). These observations indicate the possibility of controlling particle distribution by the drying conditions and slurry composition. To better understand the mechanisms, we observed during drying process with cryo-SEM experiments. As a result, we elucidate particle distribution mechanisms of each experimental conditions by effects of evaporation and sedimentation.

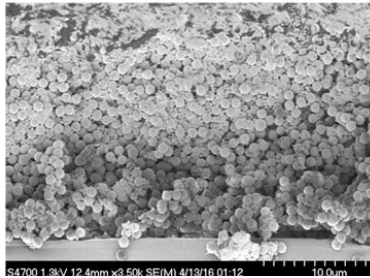


Fig.1 Cross-section image by SEM  
(Low viscosity slurry, Low drying rate)

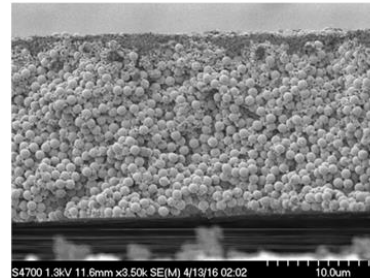


Fig.2 Cross-section image by SEM  
(Low viscosity slurry, High drying rate)

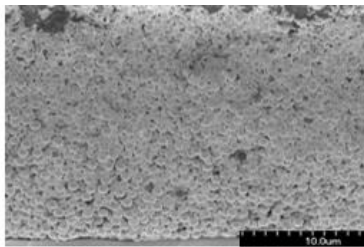


Fig.3 Cross-section image by SEM  
(High viscosity slurry, Low drying rate)

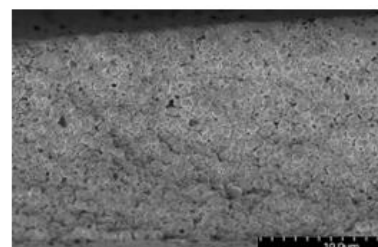


Fig.4 Cross-section image by SEM  
(High viscosity slurry, High drying rate)