

Dip coating flow analysis: wetting and confinement

_____,
*
(jaewooknam@skku.edu*)

Dip coating is a one of the methods that is used to produce a uniform thin film. Due to its simplicity, dip coating has been used in many film productions since 19th century. In this post metering coating method, the force balance among viscous force, gravity and capillary force near the curved meniscus determine the thickness. There are various numerical analyses of dip coating flow, but the most of them assumed that the container wall is "far away" from the moving substrate, which ensures that the curvature of the liquid-gas interface is zero. When the distance of between a wall of container and a substrate is not far enough, especially for the small container, such condition is not guaranteed. In this case, the wetting effect of wall of container and the confinement effect cannot be neglected because the shape of the liquid-gas interface can be changed significantly. The change of the interface results in changing capillary force, which arise due to its curvature and surface tension. In this research, influence of the wetting effect and the confinement effect on the film thickness is analyzed by the finite element computation. The predicted thickness from the Landau-Levich equation, which assumed the flat interface at the pool, will be compared with our numerical predictions, and the effect of the wetting and confinement will be discussed.