

On the drying kinetics of non-spherical particle-filled polymer films: A numerical study

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Abstract

During the coating and drying of thin polymer-particle composites, the particle geometry has a big impact on the prediction of concentration profiles in the dry film. In this work, a plate-like geometry is used to evaluate the mass transport of the particles with the aspect ratio as a variable. The experimental determination of the viscosity and sedimentation rates allows to simulate concentration profiles in the wet film while drying. A previous simulation model was automatized to describe the drying of the plate-like particles-polyvinyl alcohol-water material system using COMSOL with the initial concentration, aspect ratio, Péclet number, and Sedimentation number as input parameters. The results are summarized in drying regime maps, which show an increase of the evaporation regime, when the aspect ratio decreases due to lower particle mobility. This shows the importance of the geometry while predicting the particle distribution in the dry film and designing coating and drying processes.

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