Experimental investigation on Multicomponent Mass Transport during Drying of Ternary Poly(vinyl) Acetate Polymer Solutions

David Siebel, Wilhelm Schabel, Philip Scharfer

Institute of Thermal Process Engineering, Thin Film Technology (TFT), Karlsruhe Institute of Technology (KIT), D-76131 Karlsruhe, Germany

Corresponding author: david.siebel@kit.edu

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Multicomponent polymer solutions are used in many manufacturing processes, e.g. membrane production and optical foils. After deposition, the subsequent drying step has impact on the functionality of the final product. During drying mass transport in the coating is often a limiting factor. Despite the practical relevance, multi-component diffusion in these systems is not yet understood. Especially the mutual influence of different solvent species is theoretically well-known but in practice there are no models to describe this effect properly. The main reason is that it has been almost impossible to determine local solvent concentrations in multicomponent systems. Therefore no experimentally validated theoretical descriptions of multicomponent diffusion exist. Inverse Micro Raman Spectroscopy (IMRS) offers the possibility of in-situ measurement of solvent concentrations in thin films during drying with a high spatial resolution of about 1 to 2 µm and high accuracy.

In this work, ternary mixtures of polyvinyl acetate and the solvents toluene, methanol and dichloromethane were investigated by means of IMRS. For the binary polymer solvent systems the diffusional behavior in these systems is well-understood. The experiments have been performed by drying thin films while applying well-defined boundary conditions and measuring the concentration profiles of all components simultaneously at different positions within the sample. In the experiments the initial composition of the samples has been varied. With this information a better understanding of the underlying mass transport phenomena can be obtained. The influence of the initial composition on the drying behavior of multi-component systems will be discussed. Approaches of a numerical model-based description of the multi-component mass transport will be presented.

Please consider this topic for an oral presentation.