

ABSTRACT

THE DIFFUSION-OPTIMIZED CONVECTION DRYING TECHNIQUE AND ITS APPLICATION IN COATING AND PRINTING

by

F. Durst

**FMP TECHNOLOGY GMBH
Am Weichselgarten 34, D-91058 Erlangen**

The presentation deals with the diffusion-optimized convection drying technique as recently developed by the author and its co-workers. In the introduction, an overview of employed drying systems is given as they are applied these days in the coating and printing industry. Usually, dryers of this type are classified in accordance with the method of heat supply, applied to evaporate the solvent in the coated or printed fluid films, e.g. infrared dryers, convection dryers, etc. However, drying also means the transport of the produced vapor away from the liquid surface and, hence, considerations of drying are more complex than those applied today. This is outlined in the presentation and combined heat, mass and momentum transport considerations are presented. The transport equations for mass, momentum and energy are given as it is shown that the so-called continuity equation is applied, these days, without the molecular mass transport being in the equation. This has tremendous consequences for the computations of drying processes. The continuity equation is extended, taking molecular mass transport into account. This also has consequences for the momentum and energy transport equations and this is outlined in the paper.

The molecular mass diffusion term is used in order to explain various forms of drying. An emphasis is made on the diffusion-optimized convection drying technique, developed by the author and his co-workers for applications in the coating and printing industry. The advantages of this drying technique are outlined and it is shown that it allows drying rates to be achieved that can be 10 times higher than the drying rates obtained today with convection dryers. Practical realizations of the diffusion-optimized convection drying technique are presented, yielding drying elements, drying modules and complete drying units. Their performance is described and experimental verifications are presented to show that the theoretically predicted high drying rates can be practically realized. Results of installed diffusion-dryers in the coating industry are presented. Suggestions for further applications in various fields of coating and printing are given in the summary of the presentation.