

Evaporative Drying of Polymer Dispersions and Emulsions

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The drying behaviour of acrylic latex dispersions and alkyd oil-in-water emulsions was investigated through Magnetic Resonance (MR) microscopy. A Phase-encoded Chemical Shift Imaging technique was employed to separate the contribution of the water signal from that of the oil in the emulsion. Successive images of drying droplets provide both the total mass of water and the mass of water at various distances from the centre.

The total water weight loss as a function of time indicates that the rate-determining step of the drying process under our experimental conditions is the diffusion of water vapour in the specimen tube. The concentration of water at different distances from the centre is described well by a model of evaporative drying which, in addition to conserving the total water vapour flux in the sample tube, also incorporates a diffusion term which describes the orthogonal motion of water towards the edge of the sample. An estimation of the diffusion coefficient is given for both the latex and the emulsion systems.

MR microscopy is thus demonstrated to be a very powerful technique for the assessment of drying mechanisms, as it provides not only quantitative data on each constituent of the colloidal dispersion or emulsion, but also spatial information across the droplet.