Interactions in Paper Coating Binder Systems.

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Polymer colloids based on carboxylated styrene-butadiene and styrene-acrylic latices are the dominant binders used in the coating of paper. Frequently, soluble cobinders are also added to control the rheology and water-holding characteristics of the suspension, which contains kaolin or calcium carbonate as the coating pigment. These soluble polymers are often derivatives of cellulose or starch.

This work investigates the interactions between a carboxylated styrene-butadiene latex of mean particle diameter 185 nm, and sodium carboxymethylcellulose (NaCMC) or starch derivatives, in the proportions typically employed in paper coating.

The addition of NaCMC led to destabilisation of the latex above a critical [NaCMC]. The flocculation was studied using photon correlation spectroscopy (PCS), using NaCMC as the dilution medium and correcting for the solution viscosity in the Einstein-Stokes calculation of the diffusion coefficient. NaCMC with an M_w = 33,500 gave larger flocs than one of M_w = 325,000. The critical [NaCMC] was also higher with the lower molecular weight polymer.

The effect of coating starches on latex stability was compared with NaCMC using dynamic oscillation rheometry. Addition of NaCMC or anionic phosphate potato starch ester gave low phase angles ($<10°$), indicative of flocculation. A non-ionic hydroxyethyl corn starch ether gave inelastic suspensions (phase angle $>60°$), and failed to flocculate the latex.

These results are consistent with a mechanism of depletion flocculation, in which low molecular weight polymers are most effective. The polyelectrolyte nature of the NaCMC and phosphate starch leads to increased osmotic pressure in solution as a result of the presence of counterions.

Flocculation is likely to influence the binding properties of the latex and its distribution in the coating layer, which may adversely affect coating quality.