

Rheological Behavior of Acid-Swellable Cationic Copolymer Latexes

Damien Dupin¹, Steven P. Armes¹, Beng H. Tan² and Kam C. Tam³

(1) Dept. of Chemistry, Dainton Building, University of Sheffield, Brook Hill, Sheffield, South Yorkshire, S3 7HF, UK, (2) *Institute of Materials Research and Engineering, Agency for Science Technology and Research, 3, Research Link, Singapore 117602*, (3) *Department of Chemical Engineering, University of Waterloo, 200 University Avenue West, Waterloo, Ontario, N2L 3G1, Canada.*

2-Vinylpyridine (2VP) was copolymerized with 0.05 to 0.31 wt. % divinylbenzene (DVB) cross-linker via aqueous emulsion polymerization to produce a series of submicrometer-sized P2VP latexes. Protonation of the 2VP residues leads to a latex-to-microgel transition due to inter-chain electrostatic repulsion, as judged by dynamic light scattering. The DVB content of these pH-responsive particles strongly affects their rheological behavior. The solution viscosity of the swollen cationic microgels exhibits a maximum at approximately 0.05 wt. % DVB. Static light scattering studies on the swollen microgels confirm that the minimum amount of DVB required to just cross-link all the copolymer chains is around 0.11 wt. % DVB. Rheological studies show that the solution viscosity exhibited by P2VP microgels at low pH follows two models, depending on the microgel concentration. At low volume fractions the P2VP microgels behave as hard-spheres, as predicted by the Batchelor equation. At high volume fractions, the rheological behavior of P2VP microgels can be predicted by the Krieger-Doherty model.