CONTROLLED ADSORPTION OF METALLIC NANOPARTICLES ON POLYMERIC MICROCAPSULES WITH A VIEW TO GROWING SECONDARY CONTINUOUS METAL FILMS

J.Hitchcock1*, O. J. Cayre1, and S. Biggs1
1 Institute of Particle Science, University of Leeds, Leeds, UK
*james.reality@gmail.com

Keywords: nanoparticles, metal shell, catalysts, adsorption, microencapsulation, quartz crystal microbalance.

Small, volatile actives cannot be micro-encapsulated efficiently over the lifetime of a product using current encapsulation techniques. This is due to the inherent porosity of the polymeric membranes which are used as the capsule shell material. We have developed a method for preventing undesired loss of encapsulated actives which prevents loss of the core into ethanol over 90 days +. Oil core microcapsules are produced using oil-in-water emulsification followed by co-solvent extraction to precipitate a polymeric shell around the oil core. Metallic catalytic nanoparticles are then physically adsorbed onto the microcapsules and used to catalyse the growth of a continuous secondary metallic film via electroless deposition.

It is important to have good control over the primary nanoparticle adsorption density which requires a good control over and understanding of the original nanoparticle (NP) synthesis. In this work we use Quartz crystal microbalance (QCM) and transmission electron microscopy (TEM) to demonstrate the ability to control NP adsorption densities by varying several parameters such as concentration of polymeric stabiliser used in the original NP dispersion synthesis and NP dispersion concentration. We show that NP films form in seconds and demonstrate good adsorption energies. We also discuss/explain the semi regular hexagonal packing of the NP cores we observe under TEM.

TEM images showing NP adsorption densities on the polymeric microcapsule surfaces as a function of PVP-Pt-NP dispersion concentration.