

# **An Ellipsometric Study of the Swelling and De-swelling of Monolayers of Adsorbed Microgel Latex Particles**

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A reversibly swellable / de-swellable gel layer, such as that formed by depositing a layer of microgel latex particles on a suitable substrate, has potential controlled uptake / release applications in a number of fields. Examples might be in the release of bactericides into food processing lines or from teeth and gum surfaces in the mouth. Microgel monolayers might even be deposited on larger, hard particles for use in packed-columns for selective uptake and separation purposes.

Such applications require fundamental studies to determine whether swelling and deswelling occur in microgel layers, restricted to a solid/liquid interface, as they do for free microgel particles in dispersion. The formation and characterisation of close-packed monolayers of negative, poly (N-isopropylacrylamide)-based microgel particles onto positively charged silicon wafers will be described. The silicon wafers were rendered positive, by first oxidising their surface to silica, and then adsorbing a layer of poly(ethyleneimine). The thickness of the deposited microgel monolayers (under aqueous conditions) was determined, by spectroscopic ellipsometry, as a function of temperature (20 to 60 °C), pH (3 to 8) and added NaCl concentration (0 to 1 M). No actual desorption of the microgel particles was evident on changing the conditions, but a swelling/deswelling transition was observed around 32 °C. The thickness of the monolayer has been compared with the hydrodynamic diameter of the free microgel particles, dispersed in aqueous solution. For the poly(N-isopropylacrylamide) microgel particles, without any bulk ionisable co-monomer groups present, the temperature dependence of the ellipsometric thickness of the monolayer mirrors closely that of the hydrodynamic diameter of the free particles. When ionisable (-COOH) groups are introduced into the microgel particles, however, this correspondence is much less, because the microgel particles forming the deposited monolayer now contract strongly onto the oppositely-charged substrate surface. Nevertheless the thickness still responds to changes in pH and electrolyte concentration.