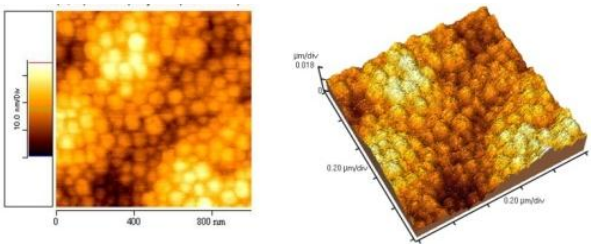
Controlling the Mechanical Properties of Polymer Films Prepared Using poly(butadiene/methacrylic acid) Dispersions

Orawan Pinprayoon[1], Alberto Saiani[1], Robert Groves[2] and Brian R. Saunders[1]

(1) *School of Materials, The University of Manchester, Grosvenor Street, M1 7HS, UK.*(2) *Synthomer Ltd, Temple Fields, Harlow, Essex, CM20 2BH, U.K.*

Despite vast applications for films prepared from carboxylated emulsion polymers, little is known about their structures at the colloidal length scale, especially the poly(Bd/MAA) films prepared from polymer dispersions. In this presentation, new insights into the film structure are given and their influence on the mechanical properties discussed. Polymer films prepared from poly(Bd/MAA) dispersions containing ZnO particles were investigated. The ZnO particles dissolved prior to film formation and provided a source of Zn^{2+} ions. We recently showed[1] that poly(Bd/MAA) particles strongly interact with divalent cations. In the present work[2] the Zn^{2+} ions form ionic crosslinks with the carboxylate groups ($RCOO^-$) within the films. We show that small amounts of added ZnO can strongly enhance the strength of the films. SAXS and DMTA (dynamic mechanical thermal analysis) data revealed that the films had two phases present: a poly(Bd)-rich phase and a poly(MAA)-rich phase. Depending on formulation conditions, distinct poly(Bd/MAA) particles could be observed by AFM (See figure below), implying that limited coalescence occurred across the particle interfaces during film formation. Ionic crosslinking of the particles is suggested to occur in the interfacial region. The ionically crosslinked aggregate structures are important species responsible for controlling the mechanical properties of these ionomer films and a conceptual model for this is presented.



AFM 2D and 3D height image of a poly(Bd/6MAA) film neutralized with ZnO

References:

[1] O.Pinprayoon, R. Groves and B.R.Saunders; *Journal o Colloid and Interface Science*, **2008**, *321*,315-322.

[2] O.Pinprayoon, A. Saiani, R. Groves and B.R.Saunders; *Journal o Colloid and Interface Science*, **2009**, *336*, 73-81.