

## **Soft-Soft Nanocomposites: a new Perspective on Design of Water-Borne Pressure-Sensitive Adhesives**

**Clara Carelli, Costantino Creton, Fanny Deplace, Andrew B. Foster, Joseph L. Keddie, Chun-Hong Lei, Peter A. Lovell\*, Keltoum Ouzineb, Michael A. Rabjohns and Tetsuo Yamaguchi\***

*Materials Science Centre, School of Materials, The University of Manchester, Grosvenor Street, Manchester, M1 7HS, UK*

Use of structured latex particles and the mechanism of film formation from latexes to produce pressure-sensitive adhesive (PSA) films with controlled sub-micron and nanoscale morphology has been practised widely. However, consideration of these materials as *soft-soft nanocomposites* is new and has led to design of PSAs with enhanced adhesive performance. The work that will be presented was funded by the European Community through an FP6 project (NMP3-CT-2004-505442) entitled "Designed Nanoscale Heterogeneities for Controlling Water-Borne Pressure-Sensitive Adhesive Performance (NsHAPe)".

Structured particle PSA latexes have been synthesised by sequential emulsion polymerisation with the specific aim of producing soft-soft nanocomposite PSA films comprising two interconnected elastomeric phases with controlled differences in crosslink density. Interfacial crosslinking between particles during film formation has been achieved by incorporating diacetone acrylamide repeat units which react with post-added adipic acid dihydrazide. Through careful design of the structured particles and manipulation of fundamental parameters known to modify adhesive performance, it is possible to produce soft-soft nanocomposite PSA films that show highly viscoelastic behaviour at small strains but elastic response at high strains, with substantial increases in adhesion energy on difficult substrates, such as polyethylene. The chemical and particle design parameters that are key to adhesive performance will be discussed and define general principles for enhancing the performance of water-borne PSAs.