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From nanostructure to macroscopic properties of soft polymers

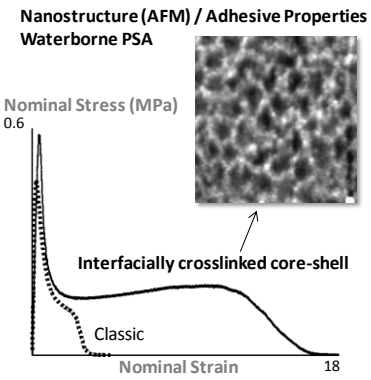
This work will summarize efforts made on the characterization and understanding of soft polymeric systems. Both PhD work targeted on waterborne nanostructured adhesives and post-doc investigations on semicrystalline thermoplastic elastomeric polyolefins will be addressed.

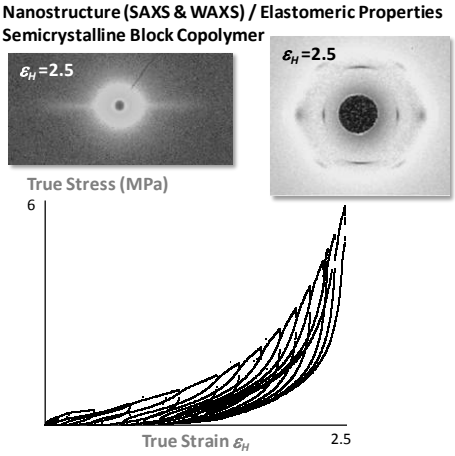
Waterborne Nanostructured Adhesives[1,2,3] *(ESPCI, Paris / PI: Costantino Creton)*

A methodology based on two rheological criteria has been proposed to optimize adhesive properties of pressure sensitive adhesive (PSA). This methodology has then been used to improve the balance between adhesion and cohesion of PSA prepared from core-shell latex particles. An interesting strategy consists in activating interparticle crosslinking reaction during the drying of the film. This crosslinking reaction has a spectacular effect on nonlinear properties of the materials. These latest are well described by a nonlinear model constructed from the combination of the Upper-Convected Maxwell model and the Gent model. Best results are obtained with PSA prepared from latex particles with a thin and crosslinked shell and a soft and slightly crosslinked core.

Structural changes of semicrystalline thermoplastic elastomeric polyolefins during step cycle mechanical processing[4] *(UCSB, Santa Barbara, USA / PI: Prof. Edward J. Kramer)*

Development of stereo- and regioselective catalysts has led to the capability to produce multiblock copolymers with crystalline isotactic or syndiotactic polypropylene blocks and ethylene-r-propylene rubbery blocks which have excellent elastomeric properties. During step cycle mechanical processing the crystals can plastically deform and transform from lamellae into rod-like fibrils. The stress-strain tensile curves provide evidence of dramatic changes in the mechanical properties and small angle and wide angle X-ray scattering experiments bring a better understanding of the structural changes of the crystals during such processing.





1.Deplace, F. et al. Journal of Adhesion 2009, 85, 18-54.
2.Deplace, F. et al. Soft Matter 2009, 5, 1440-1447.
3.Deplace, F. et al. C. ACS Applied Materials & Interfaces 2009, 1, 2021-2029.
4.Deplace, F. et al. Journal of Polymer Science Part B-Polymer Physics 2010, DOI 10.1002/POLB