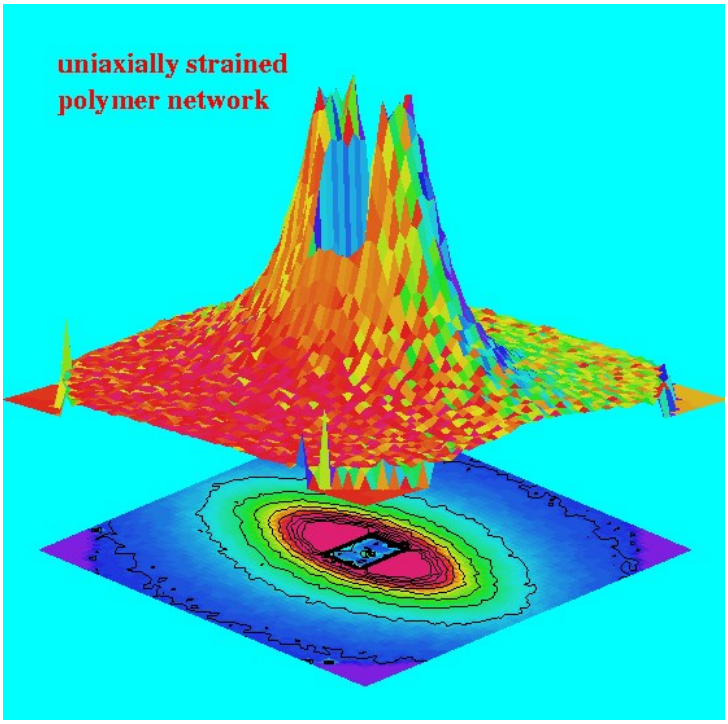

Polymer Networks, unfilled and filled elastomers

Statistically crosslinked polymer networks are studied in the framework of a tubelike constrained model. They agree with the affine premise of chain deformations whereas non-affine contributions due to the constraining potential are included.

This timely-fixed tube model explains naturally the anisotropic scattering patterns as well as the principal axes of deformation as a function of deformation ratios. Selectively center-labeled network chains allow the microscopic strain to be probed locally and the transition of affine strain with tube confinement to under-affine in a phantom model for vanishing constraints could be shown. They mirror the rouse-to-reptation transition in dynamic mechanical analyses.

For the study of filled elastomers, both model compounds as well as mineral fillers are of interest. The filler effect is to increase the elastic modulus of a compound considerably and various mechanisms have been assigned to it without microscopic proof. By means of synergic SAXS and SANS measurements, we can cope with both phases of the composites separately where both the length scales as well as the focus can be varied to identify the basic mechanisms.

Extensive use is here made of the contrast-matching technique and structure factors for more complex fillers than just spherical or rodlike are being developed in order to be applied to the lastest field of interest, i.e. layered silicates fillers . Whereas locally in the microphase separated block copolymers higher-than-affine chain deformations could be shown for the first time by SANS, it is still unknown which configuration the chain adopts in the intercalated or exfoliated state in nanocomposites and more specifically after uniaxial deformation. The instruments used are KWS1 (Jülich), Bruker SAXS Nanostar and large scale facilities (ILL,PSI,ESRF)

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