that both the critical swelling ratio and the characteristic wavelength depend on the gradient profile of material properties.

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S49-012

Micromechanics models of particulate filled elastomer at finite strain deformation

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A micromechanics-based model is proposed for the finite strain deformation of filled elastomers based on generalized Eshelby's Tanaka's method. The present formulation leads to a clear-tensor and Mori explanation of the constraint effect of rubber-like matrix on the inclusions. Comparisons with experiments and other micromechanics models are conducted. It is observed that an improvement in predictive capability for the composite with randomly dispersed particles was achieved by the present method. Based on the latest experiment of single molecular chain, a compact network model is fatherly developed to reflect the microstructure effect on the stress-strain relations of rubbery polymer and the resulting composites.

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S49-013

Transition from shear thinning to thickening in two-dimensional colloidal gels

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The linear viscoelasticity of colloidal suspensions was extensively studied in the past several decades. However, the nonlinear response of colloidal systems to high shear rate was poorly understood. Here, we performed interfacial shearing on two dimensional colloidal gels composed of microscopic colloidal particles. At the meanwhile we directly observed the microscopic structure and dynamics with optical microscope. We found that, at moderate shear rate, the viscosity of colloidal gels decreases with shear rate which is a performance of shear thinning. Whereas, above a critical shear rate, the viscosity of colloidal gels increases with shear rate indicating shear thickening. The critical shear rate was measured for colloidal gels with different area fraction and the mechanism of the transition was discussed. Micro-dynamics analysis suggested an aging process of colloidal gels under shearing. And the transition from shear thinning to thickening is due to the formation of local glassy domains.

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