Anomalous Mullins effect in crosslinked actin networks under cyclic protocol

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Abstract. The rheology of F-actin networks has attracted a great attention during the last years. In order to gain a complete understanding of the rheological properties of these novel materials, it is necessary the study in a large deformations regime to alter their internal structure. In this sense, Schmoller et al. (2010) [1] showed that the reconstituted networks of F-actin crosslinked with α-actinin unexpectedly harden when they are subjected to a cyclical shear. This observation contradicts the expected Mullins effect observed in most soft materials, such as rubber and living tissues, where a pronounced softening is observed when they are cyclically deformed. In this work, we propose a micromechanical model into the framework of nonlinear continuum mechanics. The mechanics of the F-actin filaments is modeled using the wormlike chain model for semiflexible filaments and the gelation process is modeled as mesoscale dynamics for the α-actinin and physical crosslink.The model has been validated with reported experimental results [2].

Références

1. K. Schmoller, P. Fernandez, R. Arevalo, D. Blair, and A. Bausch, Cyclic hardening in bundled actin networks *Nature Communications*, **1** 134 (2010)
2. H. López-Menéndez and J. F. Rodríguez, Microstructural model for cyclic hardening in f-actin networks crosslinked by α-actinin, *Journal of the Mechanics and Physics of Solids*, **91** 28–39 (2016)