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Tear rotation in reinforced natural rubber PAUL SOTTA, BRICE GABRIELLE, ARNAUD VIEYRES, LPMA CNRS/Rhodia, LOIC VANEL, University of Lyon, DIDIER LONG, LPMA CNRS/Rhodia, OLIVIER SANSEAU, Rhodia, PIERRE-ANTOINE ALBOUY, LPS CNRS/Universite Paris-Sud — We analyze the impact of tear rotation, that is, an abrupt instability in the direction of propagation of a notch, on the tensile strength of natural rubber elastomers reinforced with carbon black or precipitated silica, in single edge notched samples stretched at constant velocity. As a consequence of tear rotation, the energy at break increases by a factor of 6 to 8 in some cases. We show how the tensile strength of a test sample is related to the presence of tear rotations and analyze semi-quantitatively this increase in tensile strength, based on energetic arguments, without entering into a detailed description of the elastic strain field in the vicinity of the tear tip. The proposed interpretation is based on the idea that tear rotations creates a macroscopic tip radius, which relaxes the local strain (or stress) at the tear tip. Materials reinforced with carbon black or precipitated silica aggregates show similar behavior. The relation to strain-induced crystallization is discussed.

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