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Experimental Characterization and Modeling of the Non-linear Mechanical behavior of a Carbon Black Filled SBR GRIGORI MEDVEDEV, APARAJITA BHATTACHARYA, JAMES CARUTHERS, Purdue University — Filled elastomers exhibit a number of peculiar features generally referred to as Mullins effect that include (i) large stress-softening (i.e. lower stress required to pull the sample to the same strain in second pull as compared to the first one), (ii) a dramatic drop in stress at the loading reversal point during the first cycle and, (iii) complete recovery of the virgin sample-like behavior when strain in second pull exceeds the previous maximum strain. Developing a constitutive model to describe these effects has proven a major challenge. One important reason for this, rectified by the present report, has been a dearth of experimental data performed on a well-characterized system where the potentially relevant parameters (temperature, deformation rate as well as the particulate loading, dispersion, particle size, surface area, and structure of carbon black) are systematically varied. We argue that the "damage" picture, which has been the only explanation for Mullins effect advanced in the literature, is inconsistent with the experimentally observed behavior.

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