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Investigation of the Non-Linear Viscoelastic Behavior of Lightly Cross-linked SBR: The Need for a New Modeling Perspective JAMES CARUTHERS, APARAJITA BHATTACHARYA, GRIGORI MEDVEDEV, Purdue University — An extensive set of both linear and non-linear mechanical experiments including non-linear stress-strain behavior and non-linear creep/recovery has been carried out on a lightly cross-linked SBR. The results have been obtained for a wide range of temperatures, extension rates and stretch ratios. The data set reveals an unexpectedly rich behavior, which cannot be predicted by the traditional constitutive models that are based on an additive combination of hyperelastic and quasi-linear viscoelastic contributions. The inability of traditional constitutive models to describe the data is particularly striking for a high extension rate deformation followed by a slow extension rate (e.g. creep) as contrasted to deformations at slow extension rates. The hyperelastic model of rubber elasticity is shown to provide a satisfactory description of the equilibrium behavior; thus, the results in the current study indicate the need for the development of a new type viscoelastic model for elastomers. Potential candidates for the needed constitutive description will be discussed.

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