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A Microscopic Model for the Reinforcement and the Non Linear Behaviour of Filled Elastomers and Thermoplastic Elastomers (Payne and Mullins Effects) DIDIER LONG, CNRS/Rhodia, SAMY MERABIA[1], CNRS/Univ. Paris Sud, PAUL SOTTA, CNRS/Rhodia — We present a model regarding reinforcement properties of nano- structured polymers. Then, we show how it can be solved numerically by Dissipative Particles Dynamics. The model is based on the presence of glassy layers around the fillers. Strong reinforcement is obtained when these layers overlap. Key is the life-times distribution of these glassy bridges. The latter depend on polymer-filler interaction, the thermo- mechanical history, on the temperature, on the distance between fillers, and on the local stress in the material. Under applied strain, we show how the dynamics of yield and rebirth of glassy bridges account for the non-linear Payne and Mullins effects, which are a large drop of the elastic modulus at intermediate deformations, and a progressive recovery of the initial modulus when the samples are subsequently put at rest, respectively. These mechanisms account also for dissipative properties of filled elastomers. Our model opens the way for predicting mechanical behavior of nano-filled elastomers according to the filler structures and dispersion, polymer- filler interactions and temperature, in order to prepare systems with taylored properties.

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