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Large Amplitude Shear Deformations of Nano-Filled Elastomers: Evidence of Glassy Dynamics in the Vicinity of the Fillers DIDIER LONG, PAUL SOTTA, CNRS/Rhodia, SAMY MERABIA, CNRS/Universite Lyon I, AURELIE PAPON, ESPCI, FRANCOIS LEQUEUX, HELENE MONTES, CNRS/ESPCI, LAURENT GUY, Rhodia — Adding fillers in elastomers is known to increase the elastic modulus and the wear resistance of elastomers, but also to increase non-linear dissipation, a phenomenon known as the Payne effect. Indeed, when submitted to deformations of the order of a few per cents or more, the elastic modulus can decrease down to values much smaller than the initial one. On the other hand, when submitted to large amplitude oscillatory shear, frequency analysis shows that the contribution of higher harmonics to the response is quite small. This might appear somehow as a paradox since the non-linear behavior of filled elastomers can be strongly marked. We proposed a possible physical origin of these various features. We do it by comparing experimental results performed on model elastomers to the prediction of a model proposed recently, based on the presence of glassy bridges linking neighboring particles. The non-linear response is a consequence of a shift towards shorter time scales (as compared to the non-perturbed distribution) of the relaxation time distribution when a large amplitude periodic solicitation is applied. The non-harmonic response is the consequence of the fluctuation during one cycle of the distribution of relaxation times and is thus a much smaller effect.

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