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**First Observation of an "Anomalous Mullins Effect" in Silica Filled PDMS** MARILYN HAWLEY, DEBRA WROBLESKI, E. BRUCE ORLER, ROBERT HOULTON, KIRAN CHITANVIS, GEOFFREY BROWN, DAVID HANSON, Los Alamos National Laboratory — We proposed a predictive model to explain the Mullins Effect (stress softening) and a new phenomenon we refer to as the "Anomalous Mullins Effect" in silica filled polydimethysiloxane (PDMS). The mechanism we propose is based on surface interaction between polymer chains and filler particles. The "Anomalous Mullins Effect" is the dependence of stress "softening" on the direction of a second pull relative to an initial strain axis. We will present experimental data to support this model. Atomic force microscopy (AFM) phase imaging was used to characterize filler size and distribution. A tensile stage was used to measure stress-strain properties using model samples with various filler content. Samples were not pulled to break in order to study stress softening as a function of elongation and second strain direction. As predicted by our model, we observed a clear Mullins Effect only when the second strain axis was parallel to the initial one but not when it was perpendicular. No change was seen in mechanical behavior over 26 weeks or with heat-treatment.

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