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A physical mechanism for the Mullins Effect in silica-filled polydimethylsiloxane DAVID HANSON, MARILYN HAWLEY, Los Alamos National Laboratory — The Mullins Effect pertains to the reduction in tensile stress, or "softening," that is observed between the first and subsequent extensions of filled polymer materials. First reported by W. L. Holt in 1938 and later studied in detail by L. Mullins, it is considered by many to be a major unsolved mystery of polymer physics. We propose a physical mechanism to explain this effect that is based on surface interactions between polymer chains and filler particles. Its predictions are consistent with most experimental results including the integrated strain energy and the shape of the tensile stress/strain curve. The proposed mechanism also predicts that stress softening should not occur if a previously strained sample is stretched at right angles to the original strain axis. This effect, which we are calling "The Anomalous Mullins Effect," has now been confirmed experimentally. We will present a description of the mechanism.

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