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Small Angle X-ray Scattering (SAXS) to Probe the Mullins Effect in Filled Elastomers[1] ARTHUR SCHOLZ, ED KRAMER, University of California, Santa Barbara — The addition of nanosized filler particles to elastomers has long been known to improve fracture energy and increase energy dissipation. A characteristic strain softening observed during cyclic mechanical loading ("Mullins effect") is largely responsible. SAXS using synchrotron X-radiation allows us to characterize the structural changes that occur in the scale of the particles during cyclic mechanical loading and thus probe the origins of the Mullins effect. In crosslinked silica-filled siloxane elastomers the scattering is mainly due to the electron density difference between the particles and the siloxane. The symmetric SAXS pattern at zero strain is transformed into a "butterfly" SAXS pattern at true tensile strains of order 2, clear evidence of non-affine deformation of the filled elastomer, and the SAXS invariant after a cycle as well as that at the maximum strain in the cycle, increases as this maximum strain increases, strong evidence of void formation.

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