Suppoing Information

Nanomechanical Mapping of a Deformed Elastomer: Visualizing a Self-Reinforcement Mechanism

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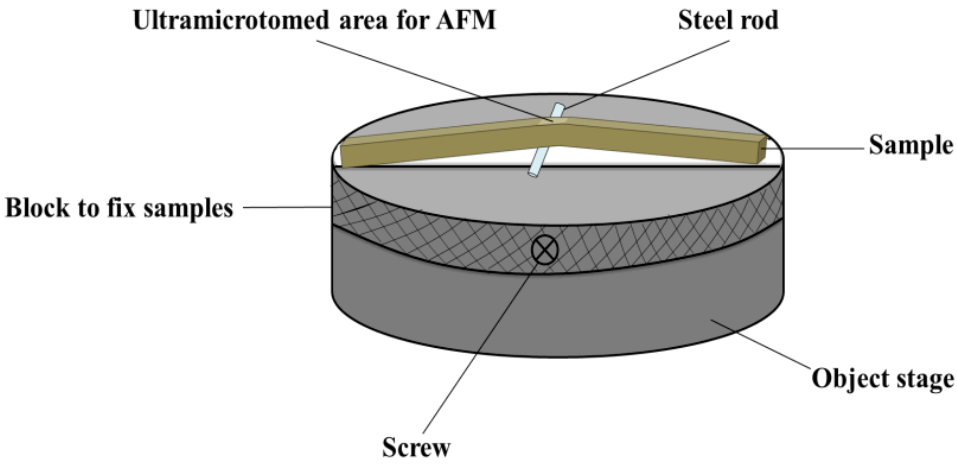

Scheme 1. Sample holder for AFM measurements.

Temperature-induced crystallization (TIC) is a common phenomenon for IR that the polymer chains will crystallize over time at temperatures between -50 °C and 10 °C. The maximal crystallization rate of the undeformed rubber takes place at approximately -25 °C and the crystallization half-time is about 2.5 hours, whereas at room temperature no crystallization occurs. The samples we used were first ultramicrotomed at −140 °C in 15 min, and then were brought out to 25 °C for 8 hours before being measured by AFM. At −140 °C, polymer chains are frozen and cannot crystallize. The results of SAXS (Figure S1) show clearly that all 2D patterns of the six samples exhibit an amorphous halo, indicating that there are no crystals after ultramicrotome and the sample preparation process does not affect the AFM nanomechanical mapping results.

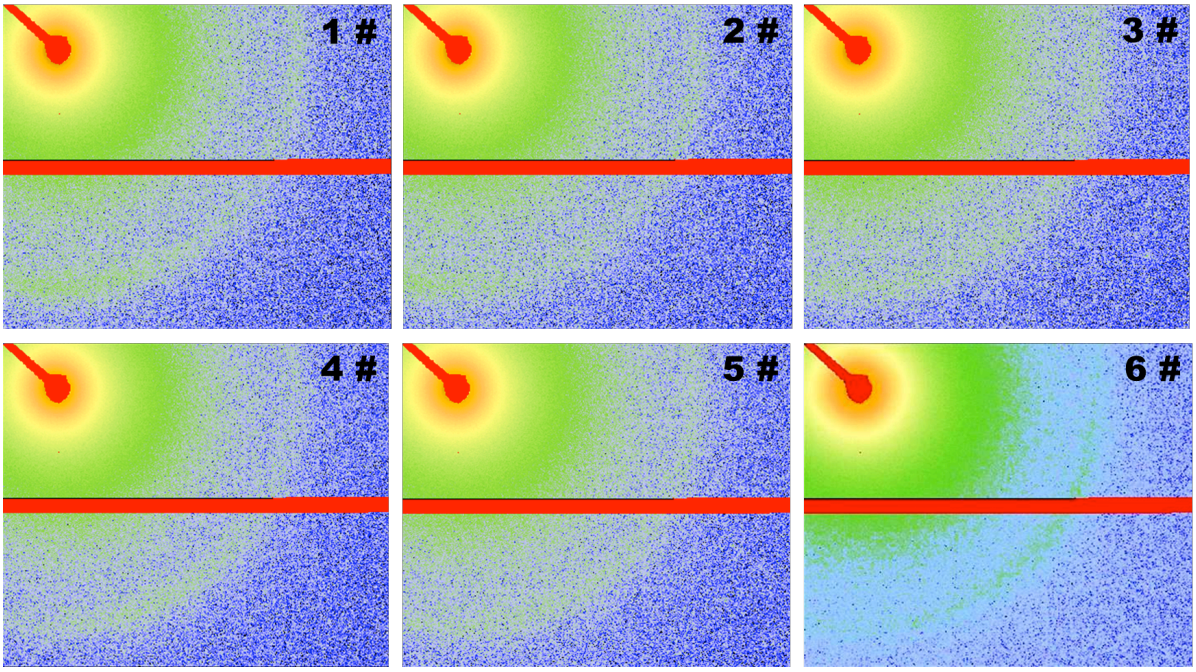

Figure S1. 2D SAXS patterns of the IR samples processed under various cooling and stretching conditions.

1# No stretching and no cooling process

2# No stretching. step 1: the sample was first put into the chamber with -140 °C for 30 min (since we usually finish the microtome process at -140 °C in 20 min); step 2: the sample was brought out from the chamber and kept at 25 °C for 8 hours, and then was measured by SAXS.

3# step 1: the sample was first stretched to 500% at 25 °C and then was kept under stretched condition at 25 °C for 30 min; step 2: the sample was put into the chamber with -140 °C for 30 min; step 3: the sample was brought out from the chamber and released from the holder; step 4: the sample was kept at 25 °C for 8 hours and then was measured by SAXS.

4# step 1: the sample was first stretched to 500% at 25 °C and then was kept under stretched condition at 25 °C for 30 min; step 2: the sample was released from the holder and kept at 25 °C for 8 hours, and then was measured by SAXS.

5# step 1: the sample was first stretched to 500% at 25 °C and then was kept under stretched condition at 25 °C for 30 min; step 2: the sample was released from the holder and kept at 25 °C for 8 hours; step 3: the sample was put into the chamber with -140 °C for 30 min; step 4: the sample was brought out from the chamber and kept at 25 °C for 8 hours, and then was measured by SAXS.

6# step 1: the sample was first stretched to 500% at 25 °C and then was kept under stretched condition at 25 °C for 30 min; step 2: the sample was put into the chamber with -140 °C for 30 min; step 3: the sample was released from the holder and kept at -140 °C for another 30 min; step 4: the sample was brought out from the chamber and kept at 25 °C for 8 hours, and then was measured by SAXS.