Supporting Information

Necessity of Two-dimensional Visualization of Validity in the Nanomechanical Mapping of Atomic Force Microscopy for Sulfur Cross-linked Rubber

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The method to convert the force curve to the force-deformation curve

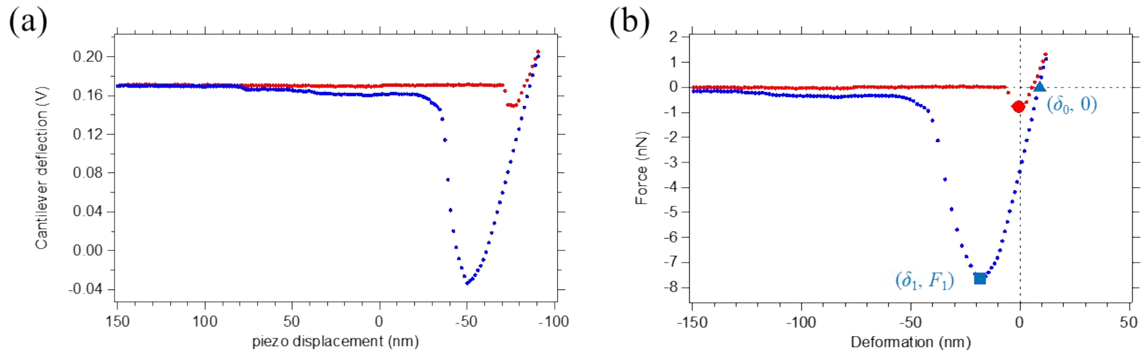

Fig. S1. An example of (a) force curves and (b) experimental force-deformation curves. Red dot is approaching process and blue dot is withdrawing process. The close circle (●) is the "jump–in–contact point", close triangle (▲) is the "balance point" (δ_0, 0), and the close square (■) is the "max–adhesion point" or "pull–off point" (δ_1, F_1).

In general, the z-piezo displacement [nm] and cantilever deflection [V] are the data obtained from the force curve mapping measurement. An example of force curves for rubber sample is shown in Fig. S1(a). Optical lever method is used in almost all AFM modes.[2] Laser is exposed at the back of cantilevers, and the cantilever deflection is detected from the changing positions of reflected ray. By applying with the spring constant [N/m] and sensitivity of cantilever [nm/V], cantilever deflection [V] is easily converted to force [nN]. Moreover, z-piezo displacement can also be converted to the sample deformation (δ), which can be defined as the remainder between z-piezo displacement [nm] and cantilever deflection [nm]. An example of force-deformation curves converted from their force curve is shown in Fig. S1(b). The details of calculation were already explained by Nakajima *et al.*[10]

References

2 P. Eaton and P. West, *Atomic Force Microscopy*, Oxford University Press, Oxford, 2010.
10 K. Nakajima, M. Ito, D. Wang, H. Liu, H. K. Nguyen, X. Liang, A. Kumagai, S. Fujinami, *Microscopy*, 2014, **63**, 193–208.