

## Polydomain–Monodomain Transition of Nematic Elastomers with Different Crosslinking Histories

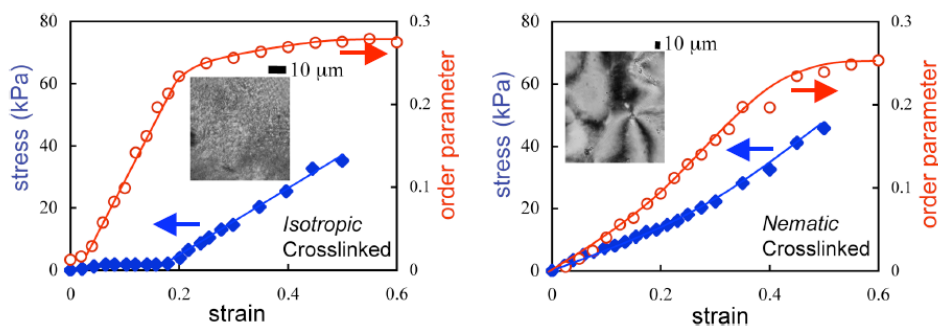
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We have investigated the stretching driven polydomain–monodomain (PM) transition of the two types of nematic elastomers each of which is cross-linked in the low–temperature polydomain nematic state or the high–temperature isotropic state (designated as N–PNEs and I–PNEs, respectively). They are similar in the order of the induced monodomain as well as the phase transition temperature, but they markedly differ in the process of the PM transitions. The transition in I–PNEs occurs under a very small constant–force condition, and the work of deformation required for forming the monodomain state ( $WPM$ ) is only a few percent of the initial shear modulus. In contrast, the transition of N–PNEs requires more than one order of magnitude larger  $WPM$ , and the formation proceeds gradually in the wide range of stress. The optical microscopy observation reveals that N–PNEs possess the memory of the initial polydomain texture before cross-linking. The broad PM transition in N–PNEs stems from the memory effect of randomness which results in a robust constraint to the reorientation of local directors.

\*Urayama, K., Kohmon, E., Kojima, M., Takigawa, T., *Macromolecules*, accepted for publication.



**Figure.** Nominal stress and order parameter as a function of nominal strain for the nematic elastomers which are originally prepared in the high–temperature isotropic state (left) and the low–temperature polydomain nematic state (right). The insets are the micrographs of the elastomer films between crossed polarizers at a temperature in the nematic state.