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Memory, Perfection and Rubber-like Behavior in Ferroelastic and Ferroelectric Inclusion Compounds. M.D. Hollingsworth, J.R. Rush, M.L. Peterson, M. Dudley, B. Raghothamachar, M.J. Abel, A.A. Black; Dept. of Chemistry, Kansas State Univ., Manhattan, KS 66506; Dept. of Material Science and Engineering, SUNY Stony Brook, Stony Brook, NY 11794.

Our work on ferroelastic and ferroelectric inclusion compounds has revealed two very different classes of materials (urea inclusion compounds and calixarenes) that exhibit reversible "memory effects" upon release of the external stress. In these materials, the daughter formed under stress reverts to the orientation of the original mother domain when the coercive force is released. With synchrotron white beam X-ray topography of urea inclusion compounds, we have shown that the rubber-like behavior and memory effects can arise because crystal growth generates invisible, epitaxially matched twins that become mismatched in the stress-induced domain switching process. This is further demonstrated by crystal structures in which displacive twins characteristic of this mechanism are created under stress. Our observation of electric field-induced poling of certain urea inclusion compounds is also consistent with metastable sites generated at the boundaries of mismatched domains. In the calixarenes, the mechanisms responsible for rubber-like behavior appear to be less straightforward.