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Adaptive Materials from Carbon Nanotube - Polyurethane Nanocomposites DANIEL POWERS, MICHAEL ARLEN, RICHARD VAIA, MAX ALEXANDER, Wright-Patterson AFRL/MLBP, HILMAR KOERNER, University of Dayton Research Institute — Adaptive materials undergo large-scale shape or property change in response to an external stimulus such as stress, temperature, light, or pH. Technological uses range from durable, shape recovery eye-glass frames, to temperature sensitive switches, to the generation of stress to induced mechanical motion. Here in, we demonstrate that the uniform dispersion of 1-5vol% of carbon nanotubes in a thermoplastic elastomer yields nanocomposites that can store and subsequently release, through remote means, up to 50% more recovery stress than the pristine resin. The anisotropic nanotubes increase the rubbery modulus by a factor of 2 to 5 (for 1-5vol%) and improve shape fixity by enhancing strain-induced crystallization. Non-radiative decay of infrared photons absorbed by the nanotubes raises the internal temperature, melting the polymer crystallites (which act as physical cross-links that secure the deformed shape) and remotely triggering the release of the stored strain energy. Comparable effects occur for electrically-induced actuation associated with Joule heating of the matrix when a current is passed through the conductive percolative network of the nanotubes within the resin.

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