Abstract
The dynamic bond can be defined as any class of bond that selectively undergoes reversible breaking and reformation, usually under equilibrium conditions. The incorporation of dynamic bonds (which can be either covalent or non-covalent) allows access to structurally dynamic polymers and composites. Such materials can exhibit macroscopic responses upon exposure to an environmental stimulus, on account of a rearrangement of the polymeric architecture. In such systems, the nature of the dynamic bond not only dictates which stimulus the material will be responsive to but also plays a role in the response itself. Thus, such a design concept represents a molecular level approach to the development of new stimuli-responsive/adaptive materials. We have been interested in the potential of such systems to access new material platforms and have developed a range of new mechanically stable, structurally dynamic polymer and nanocomposite films that change their properties in response to a given stimulus, such as temperature, light or specific chemicals. Such adaptive materials have been targeted toward applications that include healable plastics, responsive liquid crystalline polymers, adhesives, chemical sensors, and shape memory materials. Furthermore, we have also been interested in other potential uses of such materials and have initiated a program aimed at investigating their uses as templates for more complex polymer architectures. Our latest results in these areas will be discussed.