Abstract: Motivated by the persistent desire to develop new materials, which offer currently unavailable functions, research focused on the creation of polymers with tailored stimuli-responsive properties has evolved into an important field at the interface of chemistry, materials science, physics, and other disciplines. Due to their dynamic, stimuli-responsive nature, non-covalent interactions represent a versatile design element for the creation of stimuli-responsive polymers with unusual functions. This general approach is also widely used in Nature. The exploitation of specific nanostructures is another design element that has emerged in Nature to achieve specific functions. Several types of materials that rely on these general design approaches will be discussed in this presentation. Interactions that will be discussed include hydrogen-bonds, pi-pi stacking, and metal-ligand binding. Such motifs were used to assemble small molecules, supramolecular polymers, nanoparticles, and combinations of these building blocks to create mechanically mechanically adaptive and adapting, healable and other responsive polymeric materials that mimic function and/or design approaches encountered in Nature’s materials.

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