

Sophisticated Plastics: Diverse opportunities—from materials to medicine—for well-defined polymer chemistry

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Contrary to the general perception of polymers as commodity plastics, polymer science has advanced significantly to the point of having capabilities to produce highly-sophisticated, functional organic materials. This presentation will highlight the controlled polymerization of small molecule monomers and subsequent modification chemistries that are used to prepare well-defined polymer structures, and will detail their use as building blocks for the assembly of functional nanostructured materials. Synthetic methodologies have been developed for their construction as discrete nanoparticles in solution, with control over the composition, size, shape and morphology, or as bulk, multi-compartment materials in the solid state. The containment and signaling characteristics of nanoscale objects in water will be shown to provide utility for several medical applications, including gene delivery, infectious disease treatment, and cancer therapy. Transformation of intentionally-heterogeneous polymer structures and mixtures into crosslinked networks will be illustrated as a technique to create micro- and nanoscopically-complex surface coatings that behave as treacherous terrain to inhibit marine biofouling. With the diversity and control that are available, many other synthetic targets can be imagined.

