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## Progress in Polymer Hybrid Materials

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The design of polymer-based materials in which multiple constituents or phases are organized across multiple length scales to harness synergistic effects and to facilitate novel functionalities has emerged as a versatile approach to resolve challenges across a wide range of material technologies, including transparent conductors, materials for separation, energy generation and storage or drug delivery. The unique property combinations that can emerge as a consequence of the particular arrangement and interactions between the constituents provide opportunities for novel disruptive material technologies based on polymer hybrid materials. It is thus not surprising that polymer hybrid materials – i.e., materials that are comprised of synthetic polymer as well as biological or inorganic derived constituents – present one of the most rapidly growing research areas in current polymer science. Central to recent developments in polymer hybrid materials is the concept of ‘structure-related “emergent” properties’ that may be viewed as a distinguishing feature from the more established field of ‘polymer nanocomposites’ that is more concerned with the engineering of the ‘effective’ (average) properties of materials by suitable blending of constituents. Two requisites have been fundamental for the recent surge in interest in polymer hybrid materials: First, recent advancements in the field of polymer chemistry now facilitate the precise coupling of synthetic polymer and biological- or inorganic-derived constituents into complex-structured supramolecular entities that can serve as building blocks for functional materials. Second, progress in understanding of the physics underpinning the evolution of structure and properties in multiphase materials has established a foundation for the design of multicomponent materials in which individual constituents autonomously organize into superstructures with tailored properties. To harness the potential that is afforded by polymeric hybrid materials will require an

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