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Opinion
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Advanced Polymeric Materials for Electronic and Energy Applications

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Opinion

Advanced polymeric materials have showed considerable interest over the past few decades due to their tremendous advantageous coming from the combination of conventional polymeric materials and organic conductors [1-3]. Different features like mechanical, electrical, and optical properties can be founded for advanced polymers due to their confined dimensions at the nanoscale level. Advanced conductive polymers (ACPs) with synthetically tunable hierarchical 3D network structures consider to be one of the nanostructured advanced polymers. It shows great potential for a wide range of applications, such as electronics, bioelectronics and energy storage/conversion devices owing to their structural features [4].

Development of polymers with improved high-temperature properties has been catalyzed as well by the improved understanding of relationships between polymer structure, both molecular and morphological, and the physical and mechanical properties of these materials. Advances in modeling of high-temperature heat transfer in polymers have aided in the understanding of how polymers react to extreme environments [5,6]. Finally, advances made in processing of high-performance polymers and their composites continue to trigger improvements in their performance in critical applications. Herein, a broad overview of the field of high temperature properties of polymers and polymer composites is presented. The microstructure and physical/chemical properties of ACPs can be tuned by controlling the synthetic conditions such as species of monomers and cross-linkers, reaction temperature, and solvents.

By incorporating other functional polymers or particles into the ACP matrix, hybrid gels have been synthesized with tailored structures. These hybrid gel materials retain the functionalities from each component, as well as enable synergic effects to improve mechanical and electrical properties of ACPs [7]. With these improved properties, ACPs have been explored to enable novel conceptual devices in diverse applications from smart electronics and ultrasensitive biosensors, to energy storage and conversion devices. Synthetically tunable physical/chemical properties of ACPs can emerge as a unique material platform to develop novel multifunctional materials that have the potential to impact electronics, energy, and environmental technologies [8].

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