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Polymer Nanostructures Based Catalytic Materials for Energy and Environmental Applications

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Abstract : Catalytic materials have attracted continuous attention due to their promising applications in a variety of energy and environmental applications including clean energy, energy conversion and storage, purification and separation, degradation of pollutants and electrochemical reactions etc. With the advanced synthetic technologies, polymer nanostructures and nanocomposites can be directly synthesized through soft template mediated approach using swollen hexagonal mesophases and modulate the size, morphology, and structure of polymer nanostructures. As an alternative to conventional catalytic materials, one-dimensional PDPB polymer nanostructures shows high photocatalytic activity under visible light for the degradation of pollutants. These photocatalysts are very stable with cycling. Transmission electron microscopy (TEM), and AFM-IR characterizations reveal that the morphology and structure of the polymer nanostructures do not change after photocatalysis. These stable and cheap polymer nanofibers and metal polymer nanocomposites are easy to process and can be reused without appreciable loss of activity. The polymer nanocomposites formed via one pot chemical redox reaction with 3.4 nm Pd nanoparticles on poly(diphenylbutadiyne) (PDPB) nanofibers (30 nm). The reduction of Pd (II) ions is accompanied by oxidative polymerization leading to composites materials. Hybrid Pd/PDPB nanocomposites used as electrode materials for the electrocatalytic oxidation of ethanol without using support of proton exchange Nafion membrane. Hence, these conducting polymer nanofibers and nanocomposites offer the perspective of developing a new generation of efficient photocatalysts for environmental protection and in electrocatalysis for fuel cell applications.

Keywords : conducting polymer, swollen hexagonal mesophases, solar photocatalysis, electrocatalysis, water depollution
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