HYBRID NANOCOMPOSITE MATERIALS FOR ENERGY STORAGE AND CONVERSION APPLICATIONS

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Functional Hybrid materials based on conducting polymers and inorganic electroactive species provide a wealth of opportunities for the development of novel materials with improved properties (1, 2). We have concentrated our efforts in the design of nanocomposites in which polyoxometalate clusters are integrated into conducting polymer matrices (polyaniline, polypyrrole) (3, 4) (Figure). In this way, the reversible redox chemistry of polyoxometalates such as the phosphomolybdic acid (H₃Pm₀₁₂O₄₀) can be harnessed and put to work in energy-storage devices, in particular in Lithium batteries and electrochemical supercapacitors. In the latter case we have obtained polymeric materials that feature the combined activity of the conducting polymer and the inorganic nanocluster, leading to very promising cells with capacitance values of 120F/g for several thousand cycles (5).

In addition to applications and performance we will discuss the implications of our approach within the field of nanotechnology. Namely, we will analyze how these polyoxometalate clusters, traditionally known and studied in the field of molecular inorganic chemistry, could contribute to nanomaterials science as models for quantum-sized oxide clusters (6, 7).


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