Transition metal oxide coupled with 2D titanium carbide materials (MXene) as high performance electrode materials for energy storage

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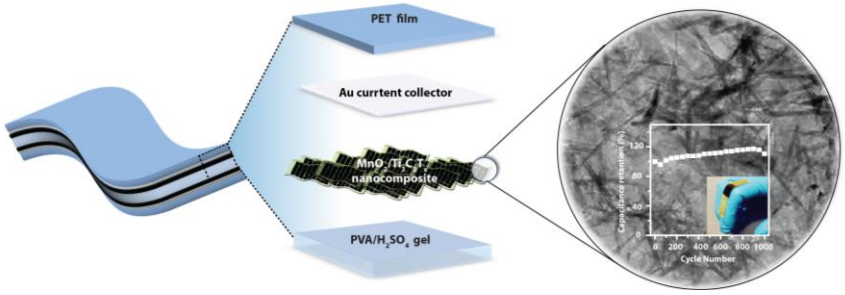
Energy storage devices, especially those with flexibility, high efficiency, lightweight, and miniaturized size, are strongly demanded for the applications of next-generation portable electronics.[1] Compared with other energy storage devices, supercapacitors (SCs) are considered as the favorable candidates in the field of flexible energy storage devices due to their long cycling life, high power density, and rapid charge-discharge rates.[2] Recently, considerable efforts have been dedicated to explore effective electrode materials with high performance for flexible SCs.[3] Among them, transition metal oxides have attracted significant attention but their poor conductivity, have limited their practical applications. To enhance their performance, a promising approach is to form hybrid structures with conductive materials. 2D titanium carbide materials (MXenes) have highly reactive surface and metallic conductivity, which is difficult to be attained in many 2D materials such as graphene, layered metal sulfides. In this work, we designed a novel $MnO_2/Ti_3C_2T_x$ nanocomposite by synergistically coupling one-dimensional MnO_2 nanorods with two-dimensional MXene sheets for flexible supercapacitors. XPS investigations suggest the obvious charge transfer from $Ti_3C_2T_x$ sheets to MnO_2 nanorods, where $Ti_3C_2T_x$ sheets serve as 2D conductive substrate to facilitate the electron transfer in the nanocomposites. The strong synergistic effect between $Ti_3C_2T_x$ and MnO_2 can greatly enhance the electrical conductivity, specific capacitance, rate stability and structural stability of the nanocomposite. This work presents an idea that MXenes can be utilized to develop advanced nanocomposites for high performance flexible electronics.



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