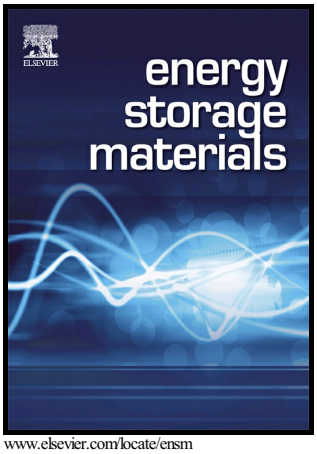

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Abstract

Fast development of smart electronics requires urgently intergrated energy storage devices, but conventional supercapacitors, using two substrates, suffer from weak flexibility, low energy density and inferior integration. Here we demonstrate a printable construction of all-solid-state high-energy planar asymmetric supercapacitors (EG//MP-PASCs) based on all-in-one monolithic films of stacked-layer pseudocapacitive MnO_2/poly(3,4-ethylenedioxythiophene)–poly(styrenesulfonate) (MP) nanosheets as positive electrode, highly ionic conductive boron nitride nanosheets as ultrathin separator (~2.2 μm), and capacitive electrochemically exfoliated graphene (EG) nanosheets as negative electrode integrated on single substrate. Notably, EG//MP-PASCs are free of conventional separators, additives, binders, and metal-based current collectors, significantly simplifying the device fabrication process. EG//MP-PASCs can be operated reversibly at high voltage of 1.8 V at polyvinyl alcohol/LiCl gel electrolyte, and exhibit