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**All-Solid-State High-Energy Planar Asymmetric Supercapacitors Based on All-In-One Monolithic Film Using Boron Nitride Nanosheets as Separator**

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**Abstract**

Fast development of smart electronics requires urgently integrated 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<sub>2</sub>/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

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