

### All-Solid-State Flexible Supercapacitor Based on Graphene Papers

최봉길, 장성진, 김세중, 허윤석\*  
한국기초과학지원연구원  
(yshuh@kbsi.re.kr\*)

Herein we fabricate all solid-state flexible asymmetric supercapacitors based on ionic liquid functionalized-chemically modified graphene (IL-CMG) film (as negative electrode) and hydrous RuO<sub>2</sub>/IL-CMG composite film (as positive electrode) separated with polyvinyl alcohol/H<sub>2</sub>SO<sub>4</sub> electrolyte. The highly macroscopic ordered layer structures of these films through direct flow self-assembly make them simultaneously an excellent electrical conductor and mechanical support, allowing them to serve as flexible electrode and current collector in supercapacitor device. Our asymmetric supercapacitors have been optimized with a maximum cell voltage up to 1.8 V, delivering high energy density (19.7 W·h kg<sup>-1</sup>) and power density (6.8 kW g<sup>-1</sup>), which are higher than those of symmetric supercapacitor based on IL-CMG films. They can be also operated even under an extremely high rate of 10 A g<sup>-1</sup>, showing high rate capability. More importantly, the superior flexibility and cycling stability have been simultaneously demonstrated by the good performance stability during 2000 cycles under harsh mechanical conditions of twisted and bent states.