

Supplementary Information for

## High Performance of Solid-State Flexible Asymmetric Supercapacitor Based on Graphene Films

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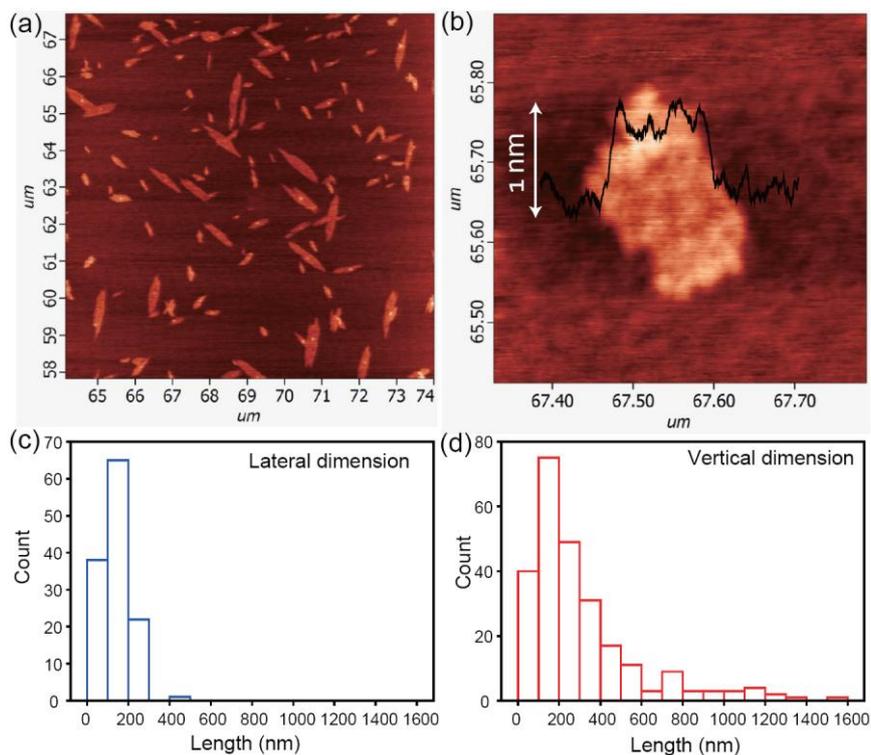
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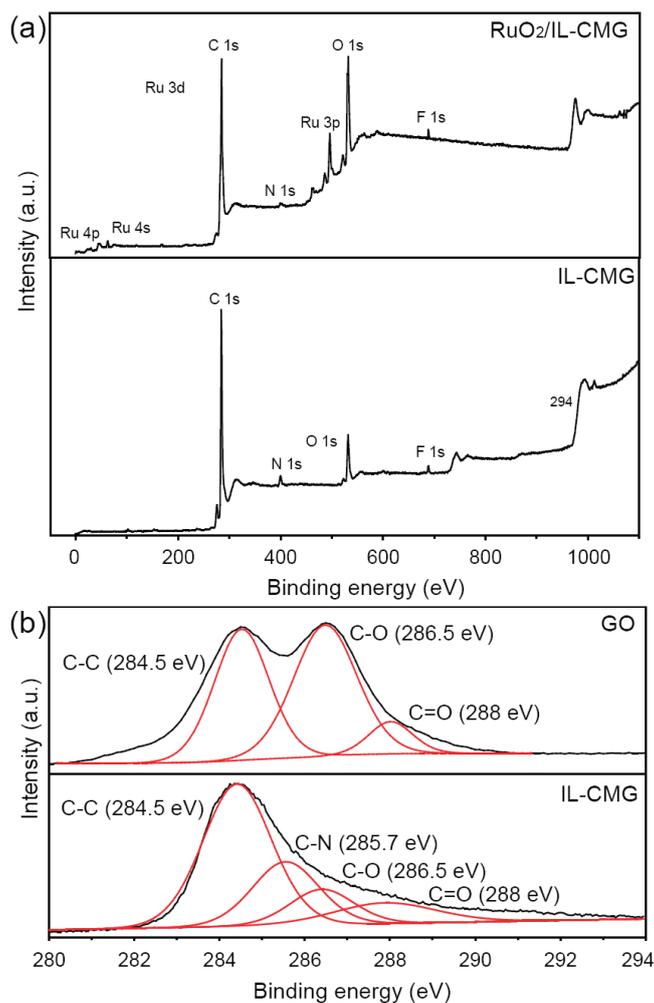


**Fig. S1** Photograph of IL-CMG and RuO<sub>2</sub>/IL-CMG films.



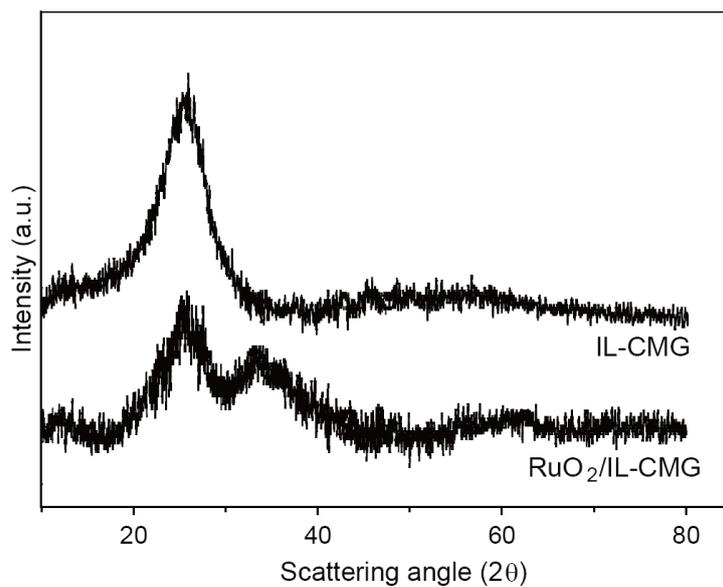
**Fig. S2** (a) and (b) AFM images of IL-CMG. (b) and (c) Size distributions of IL-CMG.

Based on AFM images, the size distribution was calculated to be 450.6 nm and 2.3 μm for lateral and vertical dimensions of GO sheets and 138.4 nm and 474.3 nm for lateral and vertical dimensions of IL-CMG sheets. The significant decrease in lateral dimensions of IL-CMG sheets is attributed to the intrinsic character of Hummers method and excessive sonication treatment.



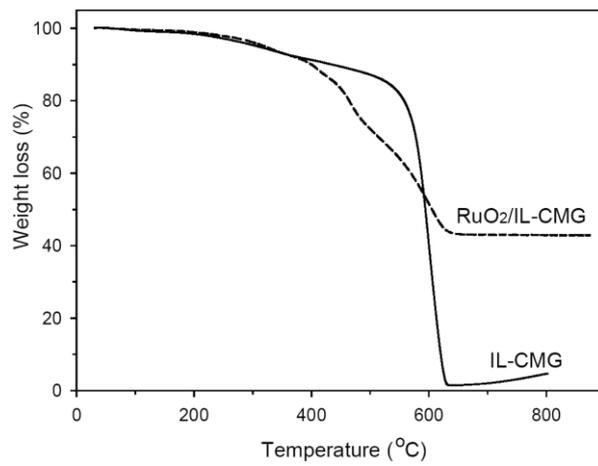
**Fig. S3** XPS spectra of RuO<sub>2</sub>/IL-CMG and IL-CMG films (Inset shows C 1s spectra of IL-CMG films.).

As shown in Fig. S3b, C 1s clearly shows the high level of oxidation state for GOs with the mainly separated three peaks at C–C (285.5 eV), C–O (287.4 eV), and C=O (288.4 eV). These peaks are in accordance with previous reports.<sup>1</sup> After functionalization with ILs and reduction reaction with hydrazine, most of C–O and C=O peaks were significantly weakened, indicating the reduction of oxygen containing groups. In addition, an additional peak assigned to C–N (285.7 eV) appeared due to the presence of N-atom containing IL molecules.<sup>2</sup> Although all of the oxygen containing groups were not reduced completely, dramatic reduction of the oxygen groups for IL-CMG compared to GOs implies the restoration of large domains of  $\pi$ -conjugated structure.<sup>2</sup> This partial removal of oxygen groups on functionalized CMGs was previously observed by other works.<sup>1,2</sup>



**Fig. S4** XRD patterns of RuO<sub>2</sub>/IL-CMG and IL-CMG films.

The peak at 24° in the XRD spectrum of IL-CMG composite films was observed. This peak was ascribed to an interlayer spacing of 0.36 nm in the CMG sheet.<sup>3</sup> The broad shoulder peak at around at 35° on RuO<sub>2</sub>/IL-CMG film indicates the amorphous structure of RuO<sub>2</sub>.



**Fig. S5** TGA curves of IL-CMG and RuO<sub>2</sub>/IL-CMG.

**Table S1.** Power density and energy density for the symmetric SC devices at different current densities (based on the total mass of the entire device).

Current density (A g <sup>-1</sup> )	0.5	1	2	5	10
Power density (kW kg <sup>-1</sup> )	0.23	0.49	1.81	3.17	5.07
Energy density (W·h kg <sup>-1</sup> )	2.95	2.93	2.90	2.84	2.82

## References

- [1] B. G. Choi, H. Park, T. J. Park, M. H. Yang, J. S. Kim, S.-Y. Jang, N. S. Heo, S. Y. Lee, J. Kong and W. H. Hong, *ACS Nano*, 2010, **4**, 2910.
- [2] T. Y. Kim, H. Lee, J. Kim and K. S. Suh, *ACS Nano*, 2010, **4**, 1612.
- [3] K. Zhang, L. L. Zhang, X. S. Zhao and J. Wu, *Chem. Mater.*, 2010, **22**, 1392.