Supplementary Data

Title: Superior performance of a vapor grown carbon fiber polymer actuator containing ruthenium oxide over a single-walled carbon nanotube

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**Fig. S1** Compare to an electrical conductivity of various polymer-supported nanocarbon/IL gel electrode layer containing the RuO$_2$.

**Fig. S2** SEM micrographs of the polymer-supported bucky-gel electrode layer (composition of 20 wt% VGCF, 48 wt% EMI[BF$_4$] and 32 wt% PVdF(HFP)); a) magnification 10,000× b) magnification 30,000× c) magnification 50,000×
**Fig. S3** CV of a cell system composed of an IL (EMI[TFSI]) electrolyte sandwiched by two bucky-gel electrode layers (RuO₂:VGCF = 1.0) (applied triangular voltage: ±2.0 V, sweep rate = 40 mV s⁻¹ (0.005 Hz)).

**Fig. S4** CV of a cell system composed of an IL (EMI[BF₄]) electrolyte sandwiched by two bucky-gel electrode layers (RuO₂:VGCF = 1.0) (applied triangular voltage: ±2.0 V, sweep rate = 40 mV s⁻¹ (0.005 Hz)).
Fig. S5 CV of a cell system composed of an IL (EMI[TFSI]) electrolyte sandwiched by two no-VGCF-gel electrode layers (RuO$_2$·xH$_2$O/EMI[TFSI]/PVdF(HFP) (=5:12:8)) (applied triangular voltage: ±2.0 V, sweep rate = 40 mV s$^{-1}$ (0.005 Hz)).

Fig. S6 Comparison of the strain calculated from the peak-to-peak value of displacement for the polymer-supported nanocarbon/EMI[BF$_4$] gel actuator and the polymer-supported no-nanocarbon/EMI[BF$_4$] gel actuator containing RuO$_2$ as a function of the applied triangular voltage (±2 V) frequency.
Fig. S7 SEM micrographs of the polymer-supported bucky-gel electrode layer (composition of 16.7 wt% VGCF, 16.7 wt% RuO$_2$ $\cdot$ xH$_2$O, 40 wt% EMI[BF$_4$] and 26.6 wt% PVdF(HFP)); a) magnification 10,000× b) magnification 30,000× c) magnification 50,000×.

Fig. S8 Comparison of the Young’s modulus for various polymer-supported nanocarbon/IL gel electrode layers containing RuO$_2$ (IL: EMI[BF$_4$] or EMI[TFSI]).