Original buckygel based redox ionic liquid: cascade of electron and ionic transfers inside ILs gelled in carbon nanotubes.

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Chemicals

The chemicals were purchased from Sigma Aldrich, except 1-butyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide, supplied by Solvionic. Solvents were purchased from the following suppliers: Dimethylformamide (VWR Chemicals), Acetone (Sigma Aldrich), Methanol (Sigma Aldrich, Chromasolv for HPLC, ≥99,9 %).

Characterization methods

Differential Scanning Calorimetry

DSC measurements were carried out on a NETSCH DSC 204-F1 apparatus. DSC thermograms were recorded on raising the temperature from -120 to 150 °C at a heating rate of 10 °C/min under nitrogen atmosphere.

Thermal Gravimetric Analyses

TGA were carried out on a Netzsch STA 409 PC apparatus under nitrogen atmosphere between 25 °C and 700 °C at a heating rate of 5 °C.min⁻¹ using ca. 10 mg samples in alumina crucible.

Cyclic voltammetry

Acetonitrile (ACN) was purchased from Fluka Chemical Co. and lithium perchlorate was purchased from ACS Reagent Co. Hydroxy-tempo was purchased from Sigma Aldrich. All voltammograms were recorded with a three-electrode system using a potentiostat VSP-300 Biologic. The reference electrode, Ag/AgCl 0.1 M in acetonitrile in a separate compartment with a dense ceramic in bottom, was directly immersed in the reaction cell. The working electrode was a glassy carbon (2 mm diameter). The counter electrode was a platinum rode. The working GC electrode was polished with alumina powder followed by washing with water and acetone before each cyclic voltammogram. In all experiment, ohmic drop is compensated.

Impedance spectroscopy

Conductivity measurements were performed on a potensiotat VSP-300 Biologic. Ionic conductivity was measured by electrochemical impedance spectroscopy on cell with constant is 1.8 cm^2 with a range frequency from 10^{-3} and 10^6 Hz .



Fig. S1 (a) DSC and (b) TGA of pure TEMPO-MeImTFSI (3-TEMPO-1-methylylimidazolium-bis(trifluoromethylsulfonyl)imide) (black curve) and rédox buckygel at 20 %wt of CNTs (red curve) recorded at 10°C/min.



Fig.S2 (a) Nynquist plot for redox Bucky-Gel at different ratio of CNTs 0.01%wt (green), 1wt%(purple), 2wt% (blue), 4wt% (grey), 10 wt% (red) and 20 wt% (pink) and (b) bode plot for redox Bucky-Gel at different ratio of CNTs, (b) Nynquist plot for *TEMPO-MeImTFSI without CNTs experimental (black) fitted(red line) and (d) TEMPO-MeImTFSI without CNTs*