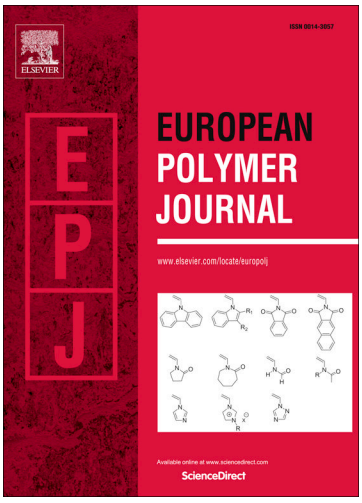

Polymer ionic liquid bearing radicals as an active material for organic batteries with ultrafast charge-discharge rate

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PII: S0014-3057(18)30745-6
DOI: https://doi.org/10.1016/j.eurpolymj.2018.07.028
Reference: EPJ 8490

To appear in: *European Polymer Journal*

Received Date: 20 April 2018
Revised Date: 16 July 2018
Accepted Date: 20 July 2018

Please cite this article as: Aqil, M., Ouhib, F., Aqil, A., El Idrissi, A., Detrembleur, C., Jérôme, C., Polymer ionic liquid bearing radicals as an active material for organic batteries with ultrafast charge-discharge rate, *European Polymer Journal* (2018), doi: https://doi.org/10.1016/j.eurpolymj.2018.07.028

Polymer ionic liquid bearing radicals as an active material for organic batteries with ultrafast charge-discharge rate

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Abstract :

We report on the synthesis of a new polymer ionic liquid (PIL) based on polyvinylimidazolium bearing a pendent nitroxide radical on each monomer unit. Firstly, the quaternization of 1-vinylimidazole by a brominated alkoxyamine, i.e. a protected tetramethylpiperidinyloxy (TEMPO) nitroxide, was achieved. Then, the bromide anion was substituted by anion exchange reaction for the bis(trifluoro-methanesulfonyl)imide (TFSI) anion. The as-obtained monomer was successfully polymerized by free radical polymerization at low temperature (40°C) by using 2,2'-azobis(4-methoxy-2.4-dimethyl valeronitrile) as initiator. Finally, the C−O bond of the alkoxyamine pendant groups was thermally cleaved releasing the redox-active TEMPO nitroxide radicals. The PIL bearing TEMPO groups was coated onto a carbon nanotubes buckypaper and tested as cathode in a lithium ion battery. Such battery remarkably exhibits a high charge/discharge rate capability, e.g. at 60C the full charge is reached in 1min and a high cycling stability; 100% of the initial capacity 60 mA h/g is kept after 1300 cycles.

Keywords:

Polymer Ionic Liquids, TEMPO, Organic radical batteries, polyvinylimidazolium