

Hybrid electrochromic devices with silyl functionalised iodide ionic liquids

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ABSTRACT

Hybrid electrochromic three-layered devices consisting of WO₃/redox electrolyte/Pt counter electrode^[1,2,3] are particularly suitable for applications, where self-erasing properties are required from the safety reasons (aircraft windows). In this study it is shown, that silylated iodide ionic liquid 1,14-bis(3-(3-(trimethoxysilyl)propyl))imidazolium-1-il)-3,6,9 trioxaundecan diiodide bearing reactive trialkoxysilane moieties capable of condensation reactions led to the formation of condensed ionic liquids with high redox conductivity (up to 10⁻² S/cm) and excellent gluing properties of electrodes. The properties of the semi-solid gel type redox electrolyte were studied in details: the condensation reactions were followed by rheological, ²⁹Si NMR and IR measurements, and the interactions between the polyiodide-imidazolium cations were also assessed. The main results inferred from our studies were related to the optimization of the iodine added into the ionic liquid, which provided sufficient amount of the polyiodide species necessary for the establishment of the Grotthus type of conductivity. Stability of the hybrid device revealed practically unchanged electrochromic response even after 5000 cycles. The main reason for such stability we attributed not only to the excellent sputtered WO₃ coatings but also to their electrochemical lithiation. The influence of the added lithium salts to the condensed ionic liquid will be discussed in details.

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