Electrochromic devices based on hydrophobic ionic liquids

Delville MH, Campet G, Duluard S, Litas I, Jung H
Institut de Chimie de la Matiere Condensee de Bordeaux
CNRS UPR 9048, Universite Bordeaux I
87 Avenue du Dr Schweitzer
F-33608 Pessac Cedex FRANCE

First abstract

Electrochromic devices (ECD) are, along with suspended-particle devices (*SPD*), one of the two most popular technologies in the area of light control. Both technologies are being developed for buildings and automotive windows, as well as mirrors. We will report here on the development of large area ECD which advantageously use hydrophobic lithium electrolytes, as an alternative to more classical non-aqueous and hygroscopic lithium electrolytes. We propose the use of hydrophobic ionic liquids-based electrolytes because (i) the ionic liquids allow the manufacturing of the devices in ambient atmosphere and (ii) they possess highly attractive intrinsic properties: non-volatility, non-flammability, high ionic conductivity and non-toxicity. We have tested the compatibility of these electrolytes with various electrochromic electrode materials, prepared either by sputtering, sol-gel process, electrodeposition, such as WO_3, $Li_{0.5}Ni_{0.50}O$, $Li_{0.5}Cr_{0.50}O_{1.25}$, Fe_2O_3, Prussian Blue, PANI. The major requirement for the inorganic oxides is to be amorphous or polycrystalline with a grain size as small as possible. Indeed, by minimizing the size of the crystallites the formation of defect bonds is favoured, particularly at the crystallite surface, acting as reversible (de) grafting sites of Li^+. The electrochemical cycling of the ECD, using 1-ethyl. 3-methylimidazolium bis-trifluoromethane sulfonimide as ionic liquid, shows reversible cycling even at elevated temperature (up to 100 °C). Moreover the long term (over several years) chemical stability is also reported.

Second abstract

Electrochemical behaviour of tungsten oxide (WO_3) and Prussian blue (PB) films in various electrolytic media including ionic liquids

Complementary tungsten oxide (WO_3) and Prussian blue (PB) electrochromic devices (ECDs), in combination with Li^+, K^+ or H^+-based electrolytes, have been proposed by many researchers for Electrochromic devices (ECD). In this study, cycling performances of ECD comprised of WO_3 and PB thin films coupled with hydrophobic lithium-conducting electrolytes are discussed. For some devices, the transmittance varied from 70% to 10.0% at 600 nm. The device was darkened or bleached by the application of 0.6 V. Repeated switching or cycling of the ECD over 1,000 cycles has been demonstrated, without noticeable degradation.