

Electrochromic devices based on PEDOT using ionic liquid based electrolytes

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ABSTRACT

A series of plastic devices composed of an inorganic oxide as ion storage layer, PEDOT as electrochromic layer and a mixture of ionic liquid and polymer based on the same ionic liquid have been assembled. It is known that inorganic oxides used in electrochromism required the presence of Li⁺ from the electrolyte in order to perform the corresponding redox reaction. However, in the present research we were able to use a Li⁺ free electrolyte by using a lithiated counter electrode. In addition, the counter electrodes were prepared at low temperatures appropriate for the deposition of thin films on plastic ITO substrates. Several strategies have been followed in order to prepare lithiated counterelectrodes. For instance in the case of vanadium oxide prepared at 150 °C, the starting V₂O₅¹ material was reduced at -0.2 V (vs. Ag/AgCl) for several minutes leading to Li_xV₂O₅ which was used as counter electrode. The electrochromic material used in these devices was PEDOT (poly(3,4-ethylenedioxythiophene)) which was synthesised following a chemical oxidative route.² The electrolyte used in this system is a mixture of ionic liquid 1-ethyl-3-butyl imidazolium PF₆ and a polymer based on such ionic liquid. Following such strategy, an electrochromic device with colour change between light yellow and bluish grey has been assembled, showing a cyclability up to 2000 cycles. Other inorganic counter electrodes such as Li_xFe-oxide has also been studied using a similar strategy.

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