Application of sol-gel vanadium oxide thin films on electronically conductive plastic substrates

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ABSTRACT

V_2O_5 is a typical intercalation compound, which on account of its semiconductivity and layered structure[1] is able to intercalate lithium ions reversibly, and therefore attracted attention also as counter electrode for electrochromic devices[2]. Lithiation of a crystalline orthorombic V_2O_5 (> 300 °C) is characterised by the formation of various phases (α-, ε-, δ-, γ-, ξ-), leading to an amorphous structure when intercalation coefficient increases beyond x = 2.5[2]. In this study, we focused on the preparation and the investigation of the electrochromic properties of the V_2O_5 thin films deposited on transparent conductive plastic substrates, important for making flexible electrochromic devices. V_2O_5 is quite suitable material for this purpose, since it exhibits significant electronic and ionic conductivity even at low processing temperatures, which did not exceed 150 °C. The films exhibited excellent adhesion properties to ITO PET substrates, showing also remarkably smooth surface when analysed with SEM microscopy. In-situ UV-visible absorbance spectroelectrochemical measurements were made in 1 M $LiClO_4$/propylene carbonate electrolyte, revealing that the films possessed sufficiently high charge capacities in order to enable the preparation of liquid electrochromic cells with poly(3,4-ethylene-dioxythiophene) (PEDOT)[3]. Performance of two different liquid cells, based on spin-coated and in-line coated PEDOT (Fraunhofer ISC, Würzburg) will be shown also from the point of view of changes in CIE Lab colour space L*a*b* coordinates.

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