Electrochromics: Fundamentals and Applications of Oxide-Based Devices

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Electrochromic materials are able to change their properties reversibly and persistently by insertion / extraction of electrical charge. These materials can be integrated in multilayer devices backed by glass or polyester foil. The optical properties are modulated by shuttling charge between an electrochromic film and a counter electrode (which also may have electrochromic properties). The charge is injected via transparent conducting films, whose properties are of great importance for the device performance. In particular, fast coloration dynamics is dependent on low resistance.

There are many applications in emerging technology: for example electrochromic devices can be employed in intelligent glass façades (“smart windows”) whose throughput of visible light and solar energy can be changed so that indoor comfort and energy efficiency are achieved simultaneously. Other applications requiring transparency control include display devices and eyewear, such as goggles and visors.

This paper summarizes recent work on electrochromics with emphasis on novel, flexible foil-type devices incorporating films based on tungsten oxide and nickel oxide films sputter deposited onto ITO-coated polyester and joined by a polymer electrolyte with adhesive properties. A number of critical issues for successful device manufacturing are outlined, and the need to have large-area thin films with controlled porosity is pointed out. High bleached-state transmittance is demanded particularly for architectural applications, and films for achieving this are discussed.