LITHIUM-BASED ELECTROCHROMIC MIRRORS

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Electrochromic devices that exhibit large dynamic ranges for reflectance in the visible and infrared regimes can now be made using a variety of materials. Devices incorporating these films can be used to improve energy efficiency in buildings and vehicles by controlling the flow of heat not only through windows and skylights, but also through opaque roof and wall panels.

Reversible deposition and dissolution of reflective metals has been demonstrated in several different configurations [1-4]. Metal-insulator transitions that accompany a wide variety of chemical reactions can also be effected electrochemically. Metal hydride switchable mirrors are based on rare earths and their alloys [5] or on mixtures of magnesium and transition metals [6], and can also be operated gasochromically. Electrochemical oxidation and reduction of copper to its oxides produces a system with reflective, transparent, and highly absorbing states [7]. Another class of switchable mirrors utilizes the interconversion of metallic and semiconducting phases *via* lithiation and delithiation in a non-aqueous electrolyte [8].

The first examples of the last type used thin films of antimony or bismuth. Reflectance modulation across most of the visible spectrum and all of the near IR spectrum was between 70% in the metallic state and 10% in the semiconducting state for a 25 nm Sb electrode. The corresponding changes in transmittance are shown in Fig. 1 at different states of charge (11 μAh/cm^2 corresponds to Li_3Sb). Similar performance is achieved with Bi films.

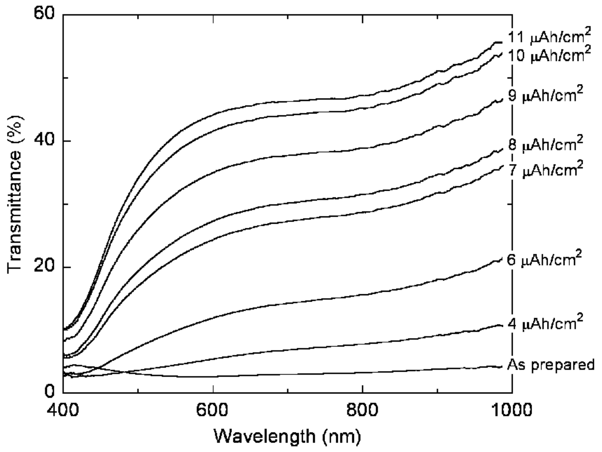

Fig. 1. Visible-near IR transmittance of 25 nm Sb film as a function of added lithium.

Li_3Sb and Li_3Bi are yellow in color. The latter exhibits a narrow range of stoichiometry accompanied by strong electrochromism, with colors ranging from yellow to deep red. Efforts to achieve more desirable colors and to improve cycling stability will be described.

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