Single element approach for electrochromic display using lithium ion conducting perovskite oxides

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Abstract

The reversible change in optical properties when a material is electrochemically oxidized or reduced is called electrochromism. Presently, there is strong interest to develop thin paper quality displays for windows and mirrors. Typically, battery-like solution phase and hybrid structured configurations have been employed for the electrochromism. Various inorganic and organic compounds have been considered [1]. The most successfully employed materials WO_3, MoO_3 and Nb_2O_5 exhibit cathodic electrochromism.

The main disadvantages of the present configurations are: (i) response fading due to reactions at interfaces, (ii) polarization sensitivity and (iii) cost of several pinhole-free thin film preparations. Accordingly, it has been suggested to use a single material with mixed ionic and electronic conductivity, which will exhibit coloration by the application of a voltage. The applied voltage causes a local change in the chemical potential of the mobile component. For example, Fe-substituted $(Li,La)TiO_3$ shows a color change from brown to light color by the application of a voltage of 1.5 V at 420 °C for 5 h in Ar [2].

The electrical conductivity of several perovskite–type lithium ion conductors in the Li-Sr-Nb-Ta-Ti-O system has been investigated. The Li^+ ion conductivity of Ta-compounds is higher than that of corresponding Nb-compounds. Substitution of Fe-in $Li_{0.3}Sr_{0.6}Ta_{0.5}Ti_{0.5}O_3$ decreases the Li^+ ion conductivity. Conductivity and polarization study of some of the mixed metal oxides with perovskite structure will be reported.

Reference:

1. R. D. Rauh, Electrochimica Acta, **44**, 3165-3176 (1999).

2. W. Weppner, Ionics, **7**, 404-424 (2001).