

Development of all-solid thin film electro-chromic devices and applications.

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The Electrochromic device (ECD) is capable of changing the optical properties such as optical transmission, absorption, reflectance, and/or emittance on application of a voltage and reverts to its original state when the polarity of the voltage is reversed. This property enables the ECD to be used for applications like smart-window, mirror, display devices and optical filters. ECD are one kind of electrochromic (EC) cells. Thus, the basic structure of solid-state ECD consists of glass substrate / transparent conducting electrode (TCO) / ion-storage layer (IS) / solid-electrolyte / EC layer / TCO. The all-solid-state ECD consists of a multilayered structure of several thin film layers of EC materials. These thin film layers of all-solid ECD are deposited by different physical vapor deposition techniques. We have made an effort to fabricate all-solid-thin film ECD having a structure of ITO / NiO / ZrO₂ / WO₃ / ITO on a glass substrate. The ECD can be characterized by the following measures: transmittance modulation, open-circuit memory effect, switching time, and cycle-life. A constant voltage (± 5 V) is applied for coloring and bleaching the device, which showed the transmittance modulation of ~56 % in visible-near infrared range. The photographs of the corresponding colored and bleached state are presented in Fig. 1. The ECD showed good open-circuit memory effect in which the states lasted for about 170 minutes. The switching time and cycle-life of the EC device are measured by applying a square-wave voltage to the device and the device shows the coloration and bleaching time of 120 s and 2 s, respectively, with a desirable cycle-life. Further, we are planning to fabricate more efficient ECD and integrating EC technology with photovoltaic (PV), which will have the self-power ECD operation.

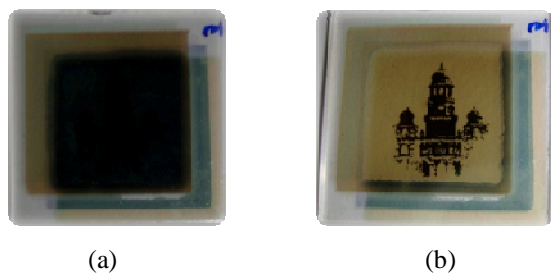


Fig. 1. The photographs of the (a) colored and (b) bleached state of ECD.