Electrochromic device based on WO_3/NiO complementary electrodes prepared by using vacuum cathodic arc plasma

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Abstract

Smart windows based on electrochromic (EC) materials, which are controlled to change their optical properties of reflectance, transmittance, and absorption can be effectively reduced the heating or cooling loads of building interiors [1]. Electrochromism can produce interesting phenomenon based on redox reaction that gives a reversible, persistent changing in color, thus with an optical modulation by a small applied DC voltage pulse difference [2]. In this study, we prepared a complementary electrochromic device (ECD) with ITO/WO_3/$LiClO_4$-PC/NiO/ITO structure was assembled. This work focues on the influence of thickness of NiO layers on the ECD electrochemical and optical properties. For the fabrication of ECD, WO_3 and NiO electrode films were used as the cathodic and anodic coloring materials, which are fabricated by vacuum cathodic arc plasma (CAP) [3-4]. We achieve a high performance electrochromic elecrode, producing porous deposited by the CAP technique is promising smart window for potential electrochromic application. Our results are observed the highest oxidation/reduction ion diffusion coefficient ($9.38x10^{-9}$ / $8.12x10^{-8}$ cm^2/s, respectively) with NiO(60 nm)/ITO films, meaning that enhanced electrochromic properties compared to the other samples. The performance of the 5×5 cm^2 ECD demonstrated optical contrast of 52 % and switching times 4.6 sec and 8.1 sec for coloring and bleaching state at the wavelength of 633 nm. During the durability test, the transmittance cahnge (ΔT) of ECD remained 45% after 2500 cycles, which was about 85% of original state.

References

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