High Performance of Electrochromic Devices based on WO3 Nanowalls

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Abstract

Tungsten trioxide thin films have been extensively studied because of their potential application in electrochromic devices. The optical properties of these films can be changed in a reversible and persistent way under the influence of an applied voltage. Electrochromism refers to the reversible change of color of thin films due to a small change in the voltage. This is important for smart windows and display applications.

Tungsten Oxide (WO_3) is a transition metal oxide with wide range of applications from gas sensors to electrochromic devices (ECD). It is difficult to prepare nanostructured materials with sputtering method in which we developed a simple method to produce WO3 nano-structures by RF magnetron sputtering. WO3 nano-walls prepared on 20 Ohm/square sputtered ITO thin films. ITO/WO3/1 M LiClO4/PC Electrolyte/ITO type ECD were prepared. ECD based on three different thicknesses of WO_3 were prepared. Performance of the ECD devices were measured by transmittance measurements applying the +-3.2 V voltage to the devices. In general, it has been observed that the turn on/off time of the devices are a few seconds. The thickest, 600 nm, WO_3 device has shown % 66.7 optical transmittance change at 700 nm within 40 s at coloration, while the medium thickness (300nm) and thinner one (180nm) has shown %54 and %32 transmittance change, respectively. Also, gaso-chromic performances of the devices were also reviewed.

Figure

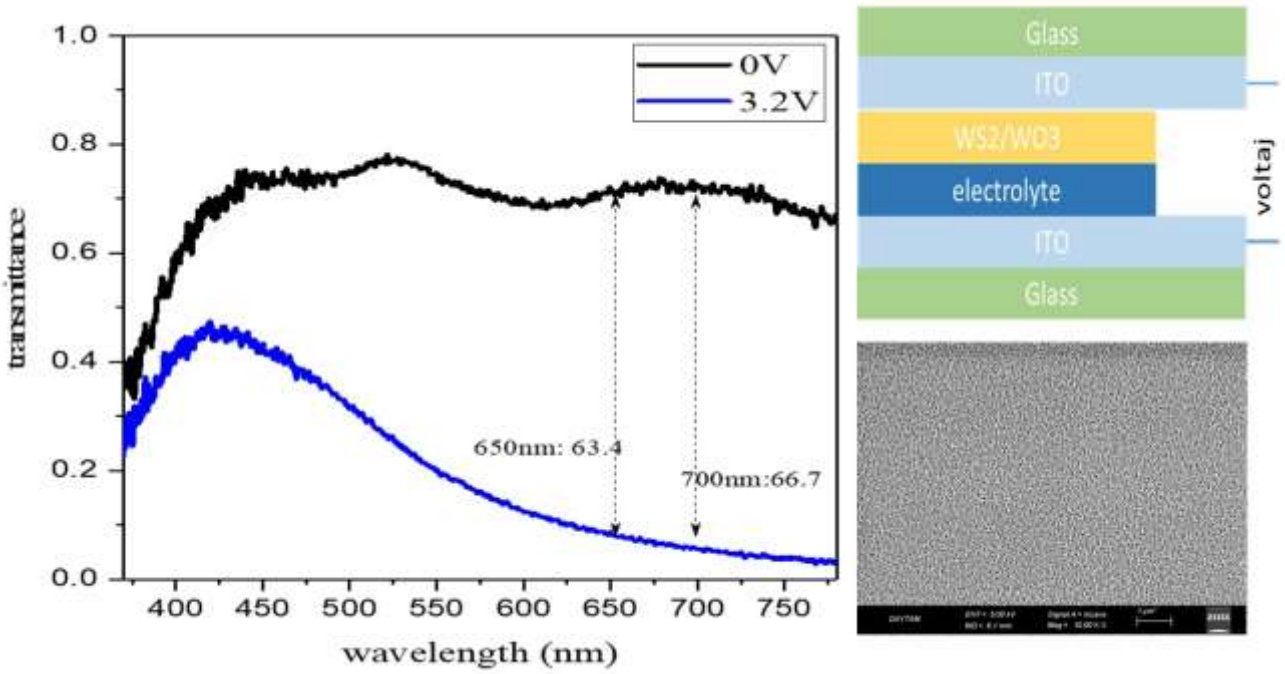

Figure 1. Electrochromic device performances of the WS_2 films converted to WO_3, device structure and nano-wall surface morphology.