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**Electron transport and electrochromic properties of sol-gel WO₃ thin films:
effect of crystallinity**

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Abstract

The influence of crystallinity on the electron transport and electrochromic properties of sol-gel WO₃ thin films has been investigated. It is observed that, at 200 °C, WO₃ films exhibits amorphous crystallinity with disk-like nanostructures while sharp crystalline in the monoclinic structure, at higher temperature (400 °C). The optical band gap of the films sees an increase first and then a decrease with increasing annealing temperature (150–400 °C). The diffusion coefficient of electrons is studied by monitoring an electron-diffusion-controlled electrochromic process and found 0.0007 cm²/s for amorphous WO₃, which is increased by an order of magnitude to 0.0066 cm²/s, in the crystalline WO₃. It is also observed that the crystalline WO₃ exhibits larger optical modulation upon electrocoloration. Electrochemical characterizations reveal high electrochromic performance for crystalline WO₃ than the amorphous one, when equal amount of charge is injected. The enhanced optical modulation of crystalline WO₃ suggests that more electrons participate in the optical transition yielding electrocoloration due to improved electron transport.

Keywords: Tungsten trioxide; Thin films; Sol-gel processes; Electron transport; Electrochromic properties

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