

## Electrochromic properties of WO<sub>3</sub> thin films sputtered with HiPIMS.

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Tungsten oxide is well known for its electrochromic and photocatalytic properties. The key of this research is to study the electrochromic properties of the WO<sub>3</sub> films obtained using the HiPIMS technology. The series of thin films of WO<sub>3</sub> were deposited using a single magnetron which was situated directly under the sampleholder. Process gas (Ar) at a flow rate of 20 sccm and reactive gas (O<sub>2</sub>) at a flow rate of 8 sccm were let in the As a power supply for the magnetron an ADL GmbH. DC unit with a MELEC GmbH. SIPP2000USB plasma DC pulse power controller was used.

Light transmittance of the samples was determined as a ratio between the intensity of the light transmitted through a maximally colored WO<sub>3</sub> film and the intensity of the light which was transmitted through a maximally decolorized film. Transmittance spectra of the maximally colored samples are displayed in the Figure 1. All films showed bluish colorification which lead to a substantial drop in light transmittance in NIR and red ranges of visible spectra. Analyzing the chart in Fig. 1 it is easy to notice that samples 1078 and 1080 are colored deeper rather than samples 1079 and 1091. This could be explained with the fact that samples were sputtered in different modes: 1091 and 1079 were sputtered in HiPIMS mode and 1080 and 1078 using DCMS. Thin films sputtered with DCMS are less dense compared to the films obtained with HiPIMS which means that inner ion transportation is possible through all of the film thickness and causes increase in electrochromic properties. Nevertheless in order to prove the statement above it is necessary to conduct a study of the densities of those films.

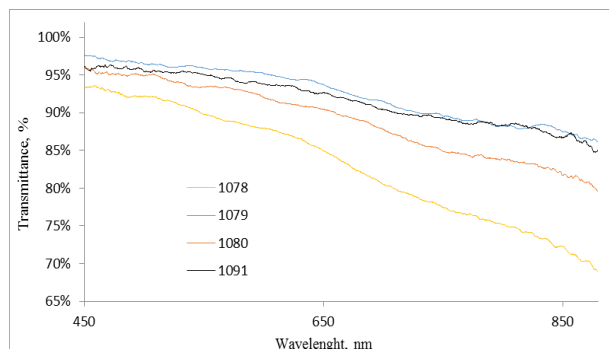


Fig. 1: Transmittance curves of the films.

Both films showed good electrochromic properties, but it needs to be said that films sputtered in DCMS showed better abilities to colorize themselves. To explain this phenomena it is needed to conduct a study of DCMS and HiPIMS WO<sub>3</sub> films porosity and density. Although the current-voltage curves were obtained the ability to endure heavy cycling by the thin films needs to be studied.

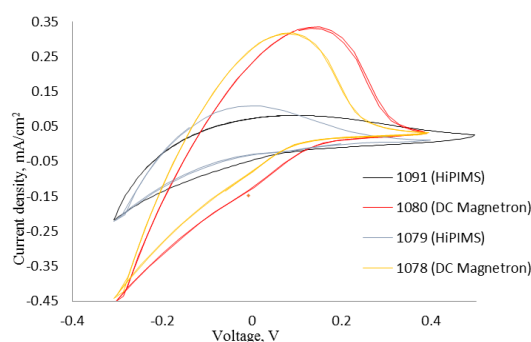


Fig. 2: Current-Voltage curves of the films.



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