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Data Article

Dataset on electro-optically tunable smart-supercapacitors based on oxygen-excess nanograin tungsten oxide thin film

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ABSTRACT

The dataset presented here is related to the research article entitled "Highly Efficient Electro-optically Tunable Smart-supercapacitors Using an Oxygen-excess Nanograin Tungsten Oxide Thin Film" (Akbar et al., 2017) [9] where we have presented a nanograin WO_3 film as a bifunctional electrode for smart supercapacitor devices. In this article we provide additional information concerning nanograin tungsten oxide thin films such as atomic force microscopy, Raman spectroscopy, and X-ray diffraction spectroscopy. Moreover, their electrochemical properties such as cyclic voltammetry, electrochemical supercapacitor properties, and electrochromic properties including coloration efficiency, optical modulation and electrochemical impedance spectroscopy are presented.

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Specifications Table

Subject area	Physics, Chemistry
More specific subject area	Materials science, Energy, Nanotechnology
Type of data	Images, Figures, Table
How data was acquired	Atomic force microscope, Raman spectroscope, X-Ray diffractometer, Electrochemical supercapacitor characteristics, Electrochromic properties, Electrochemical impedance
Data format	Raw, analyzed, etc
Experimental factors	–
Experimental features	Thin films were deposited on conducting ITO glass substrates using a RF magnetron sputtering system with different oxygen contents. Electrochemical properties of the films were investigated using potentiostat (Princeton Applied Research VersaSTAT 3) in three-electrode electrochemical cell consisting of 1 M $LiClO_4$ + PC as the electrolyte.
Data source location	Division of Physics and Semiconductor Science, Dongguk University, Seoul 04620, South Korea
Data accessibility	Data is supplied with in this article

Value of the data

- The atomic force microscopy and Raman spectroscopy provide the information about morphologies such as grain size, surface roughness, and structural characteristics of the electrode films.
- X-ray diffraction spectroscopy was used to investigate the crystal structure and the phase evolution of the tungsten oxide thin films.
- Cyclic voltammetry, electrochemical charge-discharge measurements, and chronocoulometry were used to estimate specific capacitance, coloration efficiency, and optical modulation of the tungsten oxide electrode film.
- The graph of the cathodic peak current as a function of the square root of scan rate describes the information about the electrochemical reaction mechanism of the electrode.
- AC impedance spectroscopy was used to analyze the charge-discharge process of the tungsten oxide thin film.

1. Data

1.1. Thin film characterization

The dataset presented here is related to the research article entitled "Highly Efficient Electro-optically Tunable Smart-supercapacitors Using an Oxygen-excess Nanograin Tungsten Oxide Thin Film" [9]. Atomic force microscopy, Raman spectroscopy and X-ray diffraction were used to study the structural properties of the film (Figs. S1 and S2). The oxygen content in the film was varied by changing the Ar to O_2 gas ratio: 10:0 (0% oxygen, W1 sample), 9:1 (10% oxygen, W2), 8:2 (20% oxygen, W3), 7:3 (30% oxygen, W4), and 6:4 (40% oxygen, W5). The AFM images of the electrodes are shown below. The film deposited at 20% oxygen content (W3) during sputtering shows the highest surface roughness and smallest grain size compared with the other samples. Thus, the increased roughness (or effective surface area) enhances the adsorption of Li-ion at the surface. Two characteristic Raman peaks centered at 758 and 949 cm^{-1} are associated with the O-W-O and W=O stretching mode vibrations respectively. The breadth of the O-W-O peak suggests that the film has a nanogranular