

# Electrical and optical properties of mixed phase tungsten trioxide films grown by laser pyrolysis

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## Abstract

Laser pyrolysis was chosen to synthesize tungsten trioxide starting with tungsten ethoxide precursor. The film was found to have a thickness that varied from 205 nm to 1  $\mu\text{m}$ . X-ray diffraction and Raman spectroscopy confirmed the presence of a mixture of hexagonal and tetragonal phase  $\text{WO}_3$  in the synthesized film, as well as tungsten bronzes. It was evident that annealing greatly influenced the phases and types of structures formed, and EDXS was carried out in an attempt to quantify the tungstate bronzes to tungsten oxide. I-V curves of the films showed n-type semiconducting behaviour, but the mixed phase appeared to cause a similar behaviour of dopants in a semiconductor. The refractive index decreased with increasing wavelength and gave values of up to 21 at low wavelengths. The average optical band gap was found to be 3.6 eV from UV/Vis spectroscopy. Scanning Electron Microscopy (SEM) showed a mixture of nano- and microstructures after annealing. Nanorod structures were isolated and Pt-contacted using FIB for possible applications such as an active sensing medium in gas sensors.