PROPERTIES AND ELECTROCHROMIC PERFORMANCES OF TITANIUM OXYNITRIDE THIN FILMS PREPARED BY REACTIVE SPUTTERING

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Titanium oxynitride thin films were deposited by dc reactive magnetron sputtering from a titanium metallic target, argon and nitrogen + water vapor as reactive atmosphere. A systematic change of the water vapor partial pressure from 0 to 0.1 Pa was carried out in order to prepared oxynitride compounds with various oxygen and nitrogen concentrations (from titanium nitride TiN to titanium dioxide TiO_2). Structure and morphology were analyzed by X-ray diffraction and scanning electron microscopy. Poorly crystallized or nearly amorphous oxynitride thin films were prepared with a typical columnar microstructure (Fig. 1). Nitrogen, oxygen, titanium and hydrogen concentrations were determined by Rutherford backscattering spectroscopy and by nuclear reaction analysis. With an increase of the water vapor partial pressure used during the deposition, a reverse evolution of oxygen and nitrogen contents was measured whereas hydrogen concentration was monotonously increased from 0 to 10 % at.. Optical transmittance spectra in the visible region (Fig. 2) and electrical conductivity measurements led to a gradual transition of titanium oxynitrides from metallic to semiconducting behaviors with an increasing supply of the water vapor in the deposition process.

The electrochromic performances of such compounds were finally measured and discussed taking into account structure, composition and electrical properties of the films.

References

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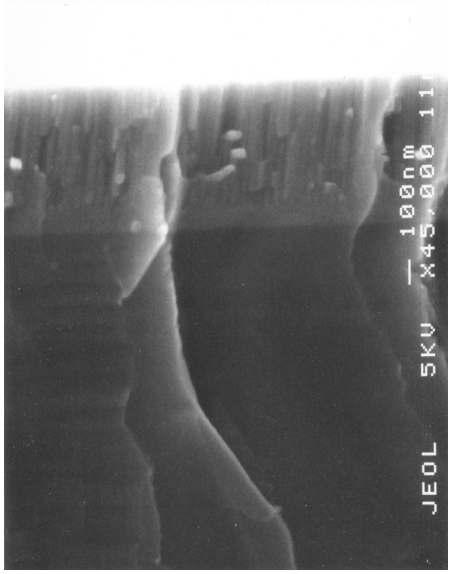

Fig. 1. Cross section observations by SEM of TiO_xN_y thin films sputter deposited on (100) silicon wafer. A typical columnar microstructure is clearly distinguished.

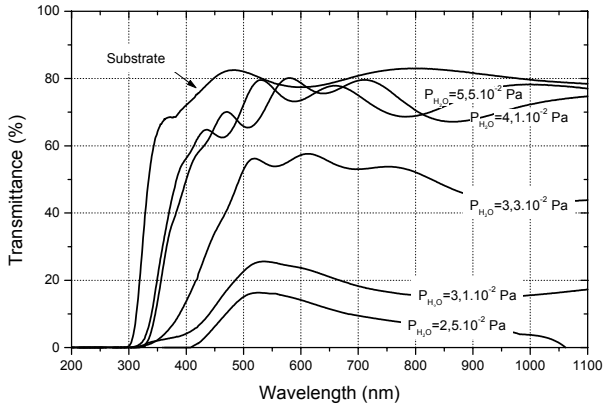

Fig. 2. transmittance spectra of TiO_xN_y/SnO_2/glass systems in the visible region. Water vapor partial pressure used during the deposition of oxynitride compounds strongly influences the optical properties of such systems.

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