Preparation and Corrosion Resistance of ZnO Films under Different Annealing Temperatures and Their Resistive Switching Behaviours

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ZnO resistive switching films were deposited on 304 stainless steel specimens using the sol-gel method under different annealing temperatures. The surface morphology, structure and composition of the ZnO films were characterized by scanning electron microscopy, energy dispersive spectroscopy, and Fourier transform infrared spectroscopy. The semiconductor properties and carrier content of the films were determined by the Mott-Schottky curve, X-ray photoelectron spectroscopy and electron spin resonance techniques, and the corrosion resistance of the films was measured by the polarization curve and electrochemical impedance spectroscopy. The experimental results showed that each prepared film was an *n*-type semiconductor with oxygen vacancies, and the grain size and concentration of the oxygen vacancies in the films increased with increasing annealing temperature. With increasing annealing temperature, the corrosion resistance of the ZnO films first increased and then decreased with the largest corrosion resistance at an annealing temperature of 400°C. By applying a negative polarization treatment, the concentration of oxygen vacancies and the corrosion resistance of the films could be restored to their original states, and the corrosion resistance of the films could be improved with prolonged immersion time due to the combination of oxygen vacancies in the films with oxygen atoms in the solution.

Keywords: ZnO film, corrosion resistance, resistive switching behaviour, annealing temperature, oxygen vacancy

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