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Effect of annealing on properties of decorative zirconium oxynitride thin films

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Abstract

Zirconium oxynitrides are excellent candidates for many technological applications, especially decorative applications. For the use of zirconium oxynitrides as decorative coatings, the thermal stability is of crucial importance. Therefore zirconium oxynitrides, containing both oxygen and nitrogen, were prepared by pulsed d.c. reactive magnetron sputtering at $pN(2)/(PN_2 + pO(2))$ of 0.98. The as-prepared films were annealed in air for 1 h. The full set of annealing was 100, 200, 300, 400, 450, 500 and 550 degrees C. The annealed zirconium oxynitride films exhibited nitrogen loss (oxidation). The nitrogen loss results in a great variance in compositional, electrical and optical properties. The energy dispersive analysis of X-ray and X-ray diffraction were used to examine the compositional and structural properties, respectively. A huge increase in the electrical resistivity was observed upon oxidation. The films annealed at higher temperatures (≥ 450 degrees C) showed insulating behavior with low extinction coefficient (<1) and reasonable refractive index values. The optical band gap values of the films annealed at 500 degrees C and 550 degrees C are in good agreement with the previously reported values for ZrO_2 .

Keywords

KeyWords Plus: OPTICAL-PROPERTIES; MECHANICAL-PROPERTIES; CORROSION-RESISTANCE; THERMAL-STABILITY; TEMPERATURE; NITRIDATION; COATINGS; TITANIUM; SI

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