PO2013

Mechanical properties of sputter deposited (Zr,Y)N thin films

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Transition metal nitrides (TMN) coatings have been deeply studied for their mechanical properties and oxidation resistance over several tens of years. Great achievements have been obtained those last 20 years, by the synthesis of nanocomposite films by adding a third or more elements to TMN. More recently, new applications of TMN coatings in the field of solar energy and plasmonics have been proposed and give rise to new interesting investigations.
This poster aims to study of the effect of Y doping on the structural and mechanical properties of ZrN-based films devoted to plasmonic purposes. Zr-Y-N films with different Y contents, up to Y/(Zr+Y) = 50 at.% have been elaborated by co-sputtering Zr and Y targets in reactive mixtures of Ar+N_2. It was observed that the NaCl B1-type structure of ZrN was conserved in the whole range of Y contents showing a linear increase of lattice parameter of the (Zr,Y)N solid solution. Variations of Young's moduli values E and hardness H of the films were estimated based on the Oliver and Pharr method by using a CSM ultra-nano hardness-tester (UNHT) equipped with a Berkovitch indenter tip working at ultralow loads in the range of 200-1000 µN. Young's moduli were also assessed by using scanning acoustic microscopy (SAM) as a complementary technique. The results showed the necessity of using a more stringent criterion that the Bückle's law used for hardness assessments and that E slowly decreased with Y content in the whole range of Y contents.

Keywords
Reactive Sputtering
Films
Mechanical Properties
Zr-Y-N
UNHT