OR1901

BIPOLAR HIGH-POWER PULSED MAGNETRON SPUTTERING OF METALLIC TITANIUM. ROLE OF ELECTRICAL PARAMETERS.

MATTHIEU MICHIELS[1], Nikolay Britun[2], Thomas Godfroid[1], Axel Hemberg[1], Rony Snyders[2]

[1]MATERIA NOVA, MONS, Belgium [2]UMons, ChIPS, MONS, Belgium

matthieu.michiels@materianova.be

Titanium is a light and abundant metal revealing excellent mechanical properties, remarkably high corrosion resistance, low thermal expansion, and low resistivity. Ti thin films are widely used in technological applications, such as surface protection and decoration, adhesion layer for Au and Ag coatings, giant magneto resistance (GMR), etc. This work is devoted to study of the high-power impulse magnetron sputtering (HiPIMS) discharge and the obtained film properties as a result of altering the electrical field polarity applied to HiPIMS cathode. This approach can be called bipolar HiPIMS (b-HiPIMS) discharge, where a negative (plasma) pulse is followed by a positive one, aiming at increasing of ion bombardment of a substrate with growing film. As shown in this study, new parameters such as the delay between the mentioned negative and the positive pulses have a significant impact on the energy of species thus affecting the Ti film growth.
The b-HiPIMS approach has been used in a PVD sputtering process and compared to DC sputtering under different bias voltages applied to the substrate during film deposition. During the process plasma stayed under a somewhat higher potential, allowing positive ion acceleration towards the substrate. As a result, clear effect of film surface modification and its microstructure is shown. Various Ti films deposited using DCMS, PDCMS and b-HiPIMS techniques on Si (100), glass and steel substrates are compared using X-ray diffraction (XRD). It is shown that the b-HiPIMS regime influences the crystallographic orientation and equivalent results compared to the DC mode are obtained on glass and steel.
The study performed in the b-HiPIMS discharge should be further extended including the other metals or composites. In particular, the resistivity and hardness measurements of the films deposited in DCMS and b-HiPIMS regimes are expected further clarify their electrical and mechanical properties.

Keywords
HiPIMS
Titanium