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Stress in HIPIMS deposited TiN thin filmsGuido Janssen¹, Daniel Magnfält², Gregory Abadias³, Kostas Sarakinos²¹TU Delft, Delft, Netherlands ²Linköping University, Linköping, Sweden ³Université de Poitiers, F86962 Chasseneuil Futuroscope cedex, France

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Intrinsic stress in TiN thin films is due to ion peening during growth, either resulting in implantation of ions from the plasma or knock on of surface atoms. The generation of intrinsic stress in TiN films depends strongly on the texture of the surface of the growing film. In reactive sputter deposition of TiN films a stress gradient of the stress has been observed. This stress gradient has been linked to a changeover of texture from (001) for thin films to (111) for thicker films. In biased HIPIMS deposition of TiN films high stresses, but no stress gradient has been observed for films up to 150 nm in thickness. Recently thick dense TiN films have been deposited by HIPIMS at room temperature on floating substrates [1]. Therefore in the present work we study the stress in TiN films grown under the conditions described in reference [1]. We deposited a series of TiN films on floating Si substrates by HIPIMS at room temperature without bias. We varied the deposition time, resulting in a series of films with thicknesses ranging from 7 nm to 2.2 μm . We determined the stress, or more accurately the Force per unit width in the films by measuring the curvature of the Si substrates before and after deposition of the films. We present the dependence of the Force per unit width on the thickness and we correlate the development of stress from the thinnest obtained films (7 nm) to the thickest films of 2 μm with the development of texture. For selected samples, the stress was also determined from XRD using the Sin2psi method adapted to the case of textured layers. We compare the obtained results to stress in films obtained by magnetron sputter deposition with bias at elevated temperature as well as to stress obtained in HIPIMS deposited films deposited with bias at elevated temperature.

[1] M. Latteman, U. Helmersson, J.E. Greene, Fully dense, non-faceted high power impulse magnetron sputtering TiN films grown in the absence of substrate heating and bias, Thin Solid Films, 518, 5979, (2010).

Keywords

Titanium nitride
HIPIMS
stress