PO1032

Optical properties of oxide thin films deposited by reactive HiPIMS

Montri Aiempanakit[1], Petter Larsson[2], Jens Jensen[3], Tomáš Kubart[4], Ulf Helmersson[2]

[1]IFM Linkoping University, Linkoping, Sweden [2]Plasma & Coatings Physics Division, IFM-Materials Physics, Linköping University, Linköping, Sweden [3]Thin film Physics Division, IFM-Materials Physics, Linköping University, Linköping, Sweden [4]The Ångström Laboratory, Uppsala University, Uppsala, Sweden

monai@ifm.liu.se

In reactive sputtering, high power impulse magnetron sputtering (HiPIMS) substantially suppress the hysteresis effect and thus increase the deposition rate of stoichiometric films as compared with direct current magnetron sputtering (DCMS) in compound mode. In this study, the effect of HiPIMS pulse frequency on the properties of Al_2O_3 and TiO_2 films has been investigated. Stoichiometric films were prepared onto Si and glass substrates at room temperature with thicknesses in the range from 140 to 200 nm. During the depositions, the pulse on time and the average discharge power were kept constant; however, the pulse frequency was varied. The composition of the deposited films was investigated by time-of-flight elastic recoil detection analysis (ToF-ERDA). In addition, structure and morphology were obtained by X-ray diffraction and Scanning Electron Microscopy (SEM). The values of refractive index and extinction coefficient were further calculated from the optical measurement using ellipsometry. The density of films was calculated from combined ERDA and SEM measurement and compared with results from ellipsometric evaluation. It is found that the properties of films depend on the pulse frequency. Low frequency (1 kHz) led to high refractive index, while the higher operation frequency (4 and 10 kHz) led only to smaller improvement over DCMS. These observations are discussed in light of energy resolved mass spectroscopic analysis of the particle flux to the substrate. Effect of various pulse trains was also investigated in order to maximize both the deposition rate and film density.

Keywords
HiPIMS
Reactive sputtering
Al2O3
TiO2
Density of films