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3P02 - Reactive Sputtering of Aluminum Acetylacetonate for Deposition of Alumina Films

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A brand new methodology for depositing alumina films in a faster, lower cost and ecologically friendly rout is proposed here: the reactive sputtering of the aluminum acetylacetonate, AAA using DC pulsed plasmas. Firstly, the AAA powder was spread on the center of the electrode of a capacitively coupled plasma system. Substrates were placed around it. Plasma was excited from argon and oxygen atmospheres by applying DC pulsed signal (-300 to -400 V, 20 kHz, 48-50 μs duty cycle) to the sample holder. Reactor walls were grounded. Deposition time was changed from 2 to 70 minutes in low (200 W) and high (500 W) power regimes. It was investigated the effect of the process time, t, and of the plasma power, P, on the deposition mechanisms, process temperature and properties of the films. Layer thickness and deposition rate were derived from profilometry analyses. Chemical composition, molecular structure and chemical states of the bonds were determined by associating energy dispersive spectroscopy, infrared spectroscopy and X-Ray photoelectron spectroscopy. Electron scanning and atomic force microscopies were used to evaluate the surface microstructure of the films whereas their crystalline structures were inspected by X-Ray diffraction experiments. Temperature of the electrode continuously increases with t and P reaching or overcoming that of sublimation of the AAA, process which affects the overall plasma activity and sputtering yield. As a consequence, thickness and deposition rate varied demonstrating the dependence of the deposition mechanisms on t and P. Further evidences of changes in the deposition kinetics were obtained by the evolution of the structure with t and P. In the regimes of low t and P, an organic structure containing Al very similar to the precursor was obtained. However, for higher P levels (500 W) an inorganic like Al2O3 structure was attained regardless t.

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