PO2078

Investigation of the expansion of an oxygen remote plasma for the growth of functional oxide thin films

Malek Tabbal[1], George Al Makdessi[2]

[1]American University of Beirut, Beirut, Lebanon [2]Universite de Montreal, Montreal, Canada

malek.tabbal@aub.edu.lb

The expansion of an oxygen low-pressure microwave plasma was investigated in order to determine the optimal plasma parameters for the oxidation of titanium and manganese thin films. Langmuir probe measurements show that the electron density increases with the injected power up to a saturation value of $3.0x10^9$ electrons/cm^3 determined at 10 mTorr while electron temperature remains constant at a value of 1.5 eV. When pressure is varied, the electron density shows a maximum value at a range from 12 to 20 mTorr while electron temperature decreases monotonously with increasing pressure. In addition, both electron density and electron temperature decrease with the axial distance from the plasma source. These effects were discussed through the losses mechanisms in the remote plasma. For a pressure of 13 mTorr and at a substrate temperature of 500 ^oC, plasma enhanced oxidation of pure metallic Ti films lead to the formation of a pure TiO_2 anatase phase compared to a mixed phase of TiO_2 and TiO in the absence of plasma activation. For Mn thin films, the exposure to oxygen remote plasma led to the formation of MnO_2 as opposed to obtaining Mn_3O_4 when oxidation is performed in the oxygen gas ambient. Remote plasma processing was thus found to provide selective pathways to control oxidation states, stoichiometry and phase composition when used for the oxidation of metallic thin films.

Keywords
remote plasma
oxides
thin films
Langmuir probe
XRD