S2-P011

Physicochemical Characterization of Mo Films at Various Oxygen Ratio

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We synthesized molybdenum thin films deposited by RF magnetron sputtering and physicochemical analysis was performed. The physical and chemical properties of these films were examined with X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS). The obtained film at the oxygen ratio of 0% showed crystallinity of cubic Mo(110) phase. After the oxygen ratio increased more than 5% in the sputter gas, the molybdenum films were formed as an amorphous phase. The thickness of the Mo thin film was drastically decreased from 1000 nm to ca 70 nm after introduction of oxygen in the sputter gas confirmed by spectroscopic ellipsometer (SE) and scanning electron spectroscopy (SEM). The calculated band gap of the film deduced from SE data increased from 3.17 to 3.63 eV by addition of oxygen in the sputter gas. The roughness of the Mo film was examined with atomic force microscopy (AFM) and it was dramatically decreased by introducing of oxygen during sputtering. XPS results revealed that the ratio of metallic Mo species in the film decreased by the contents of Mo(VI) species increased at the ratio of oxygen increased in the sputter gas and fully oxidized at low content of oxygen in the sputter gas.