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Influence of reactive oxygen species during deposition of iron oxide films by high power impulse magnetron sputtering.

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Iron oxide films were deposited using high power impulse magnetron sputtering (HiPIMS) of an iron cathode in an argon/oxygen gas mixture at different gas pressures (0.5 Pa, 1.5 Pa, and 5.0 Pa). The HiPIMS system was operated at a repetition frequency $f = 100$ Hz with a duty cycle of 1 %. A main goal is a comparison of film growth during conventional and electron cyclotron wave resonance-assisted HiPIMS. The deposition plasma was investigated by means of optical emission spectroscopy and energy-resolved mass spectrometry. Active oxygen species were detected and their kinetic energy was found to depend on the gas pressure. Deposited films were characterized by means of spectroscopic ellipsometry and grazing incidence x-ray diffraction. Optical properties, stoichiometry, and crystal structure of as-deposited films were found to depend on the deposition conditions. Deposition of hematite iron oxide films with the HiPIMS-ECWR discharge is attributed to the enhanced production of reactive oxygen species.

Keywords

HiPIMS

iron oxide

optical emission spectroscopy

mass spectrometry

XRD