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SYNTHESIS OF IRON OXIDE FILMS BY REACTIVE MAGNETRON SPUTTERING ASSISTED BY PLASMA EMISSION MONITORINGEric AUBRY¹, Alain Billard¹, Tao Liu², Frédéric Perry³, Stéphane Mangin², Thomas Hauet²¹IRTES-LERMPS, Belfort, France ²Institut Jean Lamour, Nancy, France ³PVDco, Baccarat, France

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The versatile properties and its abundance make iron oxide semi-conductor a promising material in many domains such as in catalysis, photochemistry, pigment, waste water treatment, magnetic printing, magnetic resonance imaging, microelectronic, gas sensor, etc. According to the crystallographic phase and oxygen content, their properties can be varied from a semi-conductor to half-metallic behaviour resulting in interesting optical, electrical and magnetic properties. Magnetite spinel Fe₃O₄, hematite and maghemite Fe₂O₃ and wüstite FeO are the main crystallographic phases responsible for such behaviours. The tuning of the properties of iron oxide films depending notably on their oxygen content, their synthesis by magnetron sputtering assisted by Plasma Emission Monitoring (PEM) are investigated. Metallic Fe target is sputtered in the unstable transition by means of a feedback control system of the reactive gas partial pressure indirectly measured in using optical emission spectroscopy. The chemical, structural, electrical, optical and magnetic properties are assessed as a function of the setpoint defining the oxygen-to-metal ratio in the discharge. The effect of a post-annealing temperature on their properties is also studied.

Keywords

sputtering

PEM

FeO