

Oxidation kinetics of thin and ultra-thin Fe films

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We have studied oxidation kinetics of Fe thin films under atmospheric conditions using the fact that metallic iron is a ferromagnet but ultra-thin natural iron oxides are practically nonmagnetic at room temperature. As a consequence, oxidation is associated with a loss in ferromagnetism. Fe thin films were deposited onto 1.5 nm V buffer layer using UHV magnetron sputtering. As a substrate we have used Si(100) wafers with an oxidised surface. The chemical composition and the cleanness of all layers was checked in-situ, immediately after deposition, transferring the samples to an UHV analysis chamber equipped with XPS. Results show that all samples with an initial Fe thickness greater than 6 nm oxidize practically instantaneously, whereby a constant amount of 2.5 nm of metal is transformed into oxides. For Fe thickness lower than 6 nm the time constant for oxidation increases considerably and follows an approximately linear dependence with decreasing film thickness.

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