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Abstract

Atomic layer deposition (ALD) is a vapor based technique which allows to deposit uniform, conformal films with a thickness control at the atomic scale. In this research, Al_2O_3 coatings were deposited on micrometer-sized Fe and Cu powder (particles) using the thermal trimethylaluminum (TMA)/ water (H_2O) process in a rotary pump-type ALD reactor. Rotation of the powder during deposition was required to obtain a pinhole-free ALD coating. The protective nature of the coating was evaluated by quantifying its effectiveness in protecting the metal particles during oxidative annealing treatments. The Al_2O_3 coated powders were annealed in ambient air while in-situ thermogravimetric analysis (TGA) and in-situ x-ray diffraction (XRD) data were acquired. The thermal stability of a series of Cu and Fe powder with different Al_2O_3 thicknesses were determined with TGA. In both samples a clear shift in oxidation temperature is visible. For Cu and Fe powder coated with 25 nm Al_2O_3, we observed an increase of the oxidation temperature with 300-400°C. For the Cu powder a thin film of only 8 nm is required to obtain an initial increase in oxidation temperature of 200°C. In contrast, for Fe powder a thicker coating of 25 nm is required. In both cases, the oxida-

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