

## Accepted Manuscript

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PII: S0257-8972(18)30623-6  
DOI: doi:[10.1016/j.surfcoat.2018.06.048](https://doi.org/10.1016/j.surfcoat.2018.06.048)  
Reference: SCT 23499  
To appear in: *Surface & Coatings Technology*  
Received date: 20 April 2018  
Revised date: 15 June 2018  
Accepted date: 22 June 2018

Please cite this article as: Véronique Cremers, Geert Rampelberg, Ahmed Barhoum, Perry Walters, Nathalie Claes, Thais Milagres de Oliveira, Guy Van Assche, Sara Bals, Jolien Dendooven, Christophe Detavernier, Oxidation barrier of Cu and Fe powder by Atomic Layer Deposition. *Sct* (2018), doi:[10.1016/j.surfcoat.2018.06.048](https://doi.org/10.1016/j.surfcoat.2018.06.048)

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# Oxidation barrier of Cu and Fe powder by Atomic Layer Deposition

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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<sub>2</sub>O<sub>3</sub> coatings were deposited on micrometer-sized Fe and Cu powder (particles) using the thermal trimethylaluminum (TMA)/ water (H<sub>2</sub>O) 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<sub>2</sub>O<sub>3</sub> 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<sub>2</sub>O<sub>3</sub> 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<sub>2</sub>O<sub>3</sub>, 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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