

132a Production of Oxidation-Resistant Nanosized Metal Powders

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Oxidation-resistant ultrafine metal nanopowders were produced via the decomposition of metal oxalates and in-situ coating with ceramic ultrathin films using Atomic Layer Deposition (ALD). The decomposition and coating processes were performed in a fluidized-bed reactor at low pressure and under mechanical vibration. The ceramic films prevented the diffusion of oxygen into the underlying metal at temperatures higher than ambient. Coated particles showed highly conformal and uniform films throughout their surface. The coated particles were characterized using X-ray photoelectron spectroscopy and transmission electron microscopy. The coating process did not affect the particle size distribution and surface area of the powders.

A Thermal Gravimetric Analyzer (TGA) was used to determine the optimum reaction conditions for the decomposition of metal oxalates and to test their oxidation resistance. By measuring the dynamic mass loss of the oxalate sample during reaction, it was possible to determine the decomposition efficiency. Some of the critical parameters for the decomposition are the temperature ramp rate and the hydrogen/nitrogen ratio. The synthesized powders were characterized by X-ray diffraction, oxygen and carbon content, electron microscopy, particle size distribution and surface area.

Keywords: Atomic Layer Deposition, Oxidation Resistance, Fluidization, Thin Films, Thermal Gravimetric Analysis