

## Alumina Shell Enhancement of Micron-sized Aluminum Powder and Its Anti-oxidized Properties

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**Abstract:** To increase the anti-oxidized properties of the micron-sized aluminum powder with shell-core structure, four kinds of micron-sized aluminum powder with different granularity (2.51, 5.20, 13.35, 24.02  $\mu\text{m}$ ) were slowly heated to 650  $^{\circ}\text{C}$  by a synchronous thermal analyzer at a heating rate of 20  $^{\circ}\text{C}\cdot\text{min}^{-1}$  in the oxygen atmosphere to realize the enhancement of the alumina shell of micron-sized aluminum powder. The thermal response behavior of micron-sized aluminum powder before and after treating in slowly heating condition was investigated by the thermogravimetric analysis technique. The oxidation products at different stages were analyzed by scanning electron microscopy (SEM) and X-ray diffraction (XRD). Results show that after the alumina shell is strengthened, the alumina shell of the micron-sized aluminum powder changes from amorphous state to  $\gamma$  state and the compactness increases. At the same time, the thickness of alumina shell of four kinds of micron-sized aluminum powder samples increases to 3.3–5.9 times of the original thickness. Under the condition of maintaining the high activity of micron-sized aluminum powder, the phase change and thickening of the alumina shell make the aluminum powder do not oxidize in the oxidative environment during slowly heating process below 1350  $^{\circ}\text{C}$ , still maintain higher activity and increase the anti-oxidized properties greatly. The mechanism of slow oxidation of the micron-sized aluminum powder is changed from “shell broken” reaction mechanism with weight gain in stages to oxidation inhibition mechanism after the alumina shell is strengthened.

**Key words:** micron-sized aluminum powders; core-shell structure, alumina shell enhancement, thermal response, anti-oxidized behavior

CLC number: TJ55; O65

Document code: A

DOI: 10.11943/CJEM2017293



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