Synthesis of Nanosize Aluminum powders by Electrical Explosion of Wire in the Gaseous Media

School of Electrical Engineering, Xi’an Jiaotong University, Xi’an 710049, China.

The wire electrical explosion (WEE) method is a new gas-phase synthesis method for the production of nanosize powders. And the WEE method has the advantages of high energy efficiency and high purity through the production under pure inert gas conditions. In the paper, an experimental device based on the electrical explosion of metallic wires for the nanopowders production and collection was designed and built. Also, aluminum nanopowders were produced by electrical exploding aluminum wire and collected by the microporous membrane filter successfully under different experimental conditions. And the influence of these experimental conditions on the characteristics of aluminum nanopowders was analyzed by the transmission electron microscope images. Moreover, the discharge channel structure upon electrical explosion of wires was studied by the high-speed framing camera. The results showed that the size and composition of the aluminum nanoparticles can be controlled by many parameters, such as the energy-storage capacitor and its charging voltage, the gaseous media as well as their pressures and temperature, the wire materials and its diameters. However, only the influences of the electrical energy entering the wire and the pressure of surrounding gas on the dimension of the aluminum nanopowders were discussed in detail.