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Fabrication of nickel filter by uniaxial pressing process for gas purification: ceramic coating effect for hot gas cleaning

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ABSTRACT

A nickel filter for hot gas cleaning was successfully fabricated by pressing micron-size nickel powder. The deposition of the alumina coating on nickel powder having a particle size distribution of 2 to 10 μm is the first step in the fabrication procedure. The raw nickel powder and alumina modified nickel powder were pressed in a cylindrical metal mold under a pressure of 42 MPa and then heat treated in the temperature ranges of 450–900°C and 1100–1400°C, respectively, for 10 h in pure hydrogen to endow them with thermal stability and mechanical strength. SEM, mercury porosimetry and the air permeation test showed that the alumina coating on the surface of the nickel powder hindered the sintering and agglomeration of nickel up to 1200°C, while the pore structure of the un-modified nickel filter was destroyed at 550°C. We believe that the nickel filter developed herein could be applied not only to high temperature processes, such as solid fuel gasification for the reliable and environmentally sound operation of subsequent processes, but also provide energy savings and more effective whole process optimization.

Keywords: Filter; Hot gas cleaning; Nickel powder; Pressing; Alumina coating

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