

FLUIDIZATION OF COHESIVE NANOPARTICLES WITH A NEW PULSATION TECHNIQUE

Jamal Chaouki, Dept. of Chemical Engineering, École Polytechnique de Montréal, C.P. 6079, Succ. Centre-Ville, Montréal, QC, Canada, H3C 3A7
jamal.chaouki@polymtl.ca

Samira Aghaee Sarbarze, Mohammad Latifi, Dept. of Chemical Engineering, École Polytechnique de Montréal, C.P. 6079, Succ. Centre-Ville, Montréal, QC,

The nanoparticles are building block of many advanced materials that are developed for a variety of industries.

Fluidization of the nanoparticles can improve dramatically quality of the final material in processes such as coating, drying and crystallization because of enhanced mixing conduction in a fluidized bed. However, due to severe presence of interparticle forces, the nanoparticles are very cohesive, and thus their fluidization is impossible with conventional methods.

Authors developed a novel pulsation-assisted technic to effectively fluidize the nanoparticles of different types. The developed fluidization technic was primarily investigated inside a transparent tube with 2.5 cm diameter and 20 cm height. A solenoid valve was located in the reactor outlet to switch between ON and OFF positions to intermittently pressurize the gas inside the reactor and then let it exit. Two differential pressure transducers and a high-speed camera recorded the pressure fluctuations of the bed. Superficial gas velocity and intermittence frequency of the solenoid valve were varied to investigate fluidization quality. An experimental procedure was developed to estimate the maximum amount of interparticle forces between the nanoparticles in the bed.

Investigations showed under optimum conditions when the solenoid valve was open an upward lift force was generated that helped fluidize the bed. The lift force was greater than sum of the bed weight and the maximum interparticle forces minus the drag force. Bed fluctuations were examined at temperatures 650, 700 and 750 °C, and it was revealed that the developed technique could be optimized to work at such temperatures.