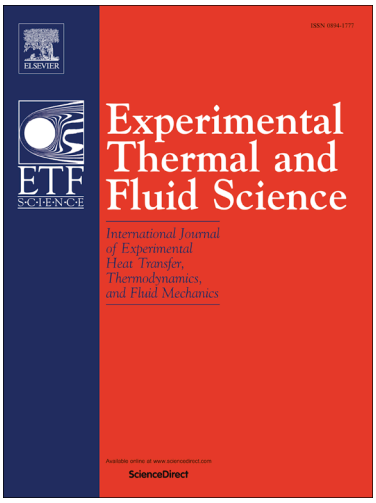

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Effect of Temperature on Fluidization of Hydrophilic and Hydrophobic Nanoparticle Agglomerates

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Abstract

The hydrodynamics of fluidized beds of hydrophobic and hydrophilic nanoparticles at elevated temperatures was investigated by analyzing pressure fluctuations in time-, frequency-, time-frequency domains and wavelet transform. The cohesive interparticle force (IPFs) was adjusted by changing the bed temperature to investigate the effect of IPFs on the behavior of hydrophobic silica (R972) and hydrophilic titania (P25) nanoparticles. Standard deviation and the power spectral density function of pressure fluctuations showed that increasing the bed temperature can convert the fluidization regime from APF to ABF for hydrophobic silica nanopowder. Larger agglomerates and bubbles were formed in the bed at higher temperatures. In contrast, hydrophilic titania becomes fluidized in the ABF regime at lower temperatures and the bed tends to fluidize as the APF regime at further temperatures. Based on the wavelet transform analysis, the energy of small bubbles and agglomerates is dominant for both types of nanopowders.

Keywords: Agglomerate; Fluidization; Nanoparticle; Pressure fluctuations; Temperature

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