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TRANSPORT PHENOMEN A & FLUID MECHANICS

快速流化床中颗粒团聚现象的数值模拟——曳力关联式的选择

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摘要 Drag force is a key parameter in the numerical modeling of gas-particle flow in circulating fluidized beds. The reliability of current drag force correlations over the regime of fast fluidization has, however, not been thoroughly investigated. In this article, a drag force correlation accounting for the clustering effects for Geldart A particles is used to simulate the behaviors typical of fast fluidization, including dynamic evolution of clusters as well as time-averaged axial and lateral voidage profiles. Diverse images of clusters are captured and the time-averaged profiles of voidage are shown tobe in quantitative agreement with the present empirical correlation. The results based on different constitutive correlations of drag force show the importance of the choice of drag force in modeling fast-fluidized beds. This drag force correlation, based on a simple averaging assumption, could give some basic insights about the magnitude of the drag reduction.

关键词 流化床 群体效应 模拟技术 曳力 运动学 化工设备

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Simulation of the Clustering Phenomenon in a Fast Fluidized Bed: The Importance of Drag Correlation

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Abstract Drag force is a key parameter in the numerical modeling of gas-particle flow in circulating fluidized beds. The reliability of current drag force correlations over the regime of fast fluidization has, however, not been thoroughly investigated. In this article, a drag force correlation accounting for the clustering effects for Geldart A particles is used to simulate the behaviors typical of fast fluidization, including dynamic evolution of clusters as well as time-averaged axial and lateral voidage profiles. Diverse images of clusters are captured and the time-averaged profiles of voidage are shown tobe in quantitative agreement with the present empirical correlation. The results based on different constitutive correlations of drag force show the importance of the choice of drag force in modeling fast-fluidized beds. This drag force correlation, based on a simple averaging assumption, could give some basic insights about the magnitude of the drag reduction.

Key words drag force; kinetic theory; granular materials; fast fluidization; multiphase flow; simulation

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