10.07.2024

Project work / Bachelor's thesis / HiWi

Impact of mechanical vibration on bubbling gas-solid fluidized bed hydrodynamics

Motivation:

Enhanced heat and mass transfer resulting from greater solid-fluid interaction in fluidized beds make them a favorable reactor choice in many processes. Fluidization behavior can be further improved with mechanical vibration. It is possible to decrease the minimum fluidization velocity and reduce gas channeling and particle agglomeration in mechanically vibrated fluidized beds [1,2].

In this project, the impact of vibration on the minimum fluidization velocity will be investigated. The aim is to find an equation to determine the minimum fluidization velocity under vibrated conditions in pseudo-2D and 3D fluidized beds.

Tasks:

- Determination of the minimum fluidization velocity in vibrated gas-solid fluidized beds.
- Investigation of bubble characteristics with high-speed camera and digital image analysis with Python.
- Investigation of the impact of particle properties on vibrated fluidized bed hydrodynamics.

(a) (b) (c)

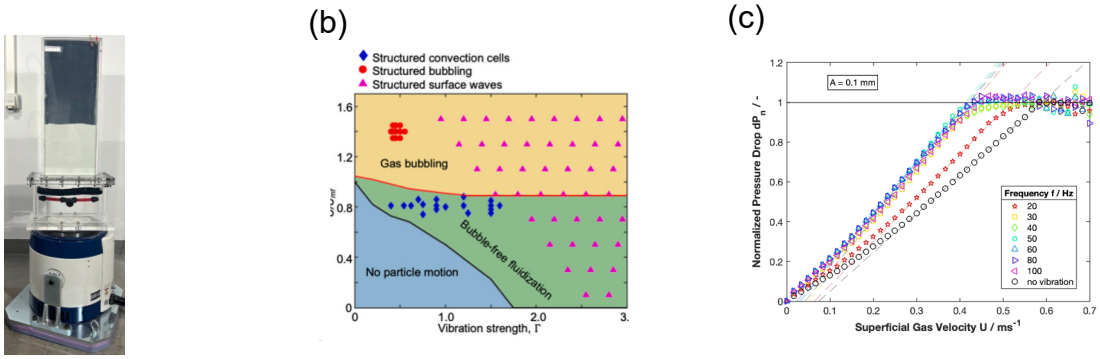

Figure 1: (a) Experimental setup. Fluidized bed is attached to the vibration source, an electrodynamic shaker. (b) Impact of mechanical vibration on fluidized bed hydrodynamics. Different fluidization regimes can be obtained in vibrated fluidized beds [3]. (c) Initial results show the reduction of minimum fluidization velocity with mechanical vibration.

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Other projects involving vibrated fluidized beds are available for Master's theses, Bachelor's theses, and project work. Feel free to contact for further information.

[1] Wang, A.; Marashdeh, Q.; Teixeira, F. L.; Fan, L.-S. Applications of Capacitance Tomography in Gas–Solid Fluidized Bed Systems. In Industrial Tomography; Elsevier, 2015; pp 529–549. https://doi.org/10.1016/B978-1-78242-118-4.00020-4. [2] Penn, A.; Tsuji, T.; Brunner, D. O.; Boyce, C. M.; Pruessmann, K. P.; Müller, C. R. Real-Time Probing of Granular Dynamics with Magnetic Resonance. Sci. Adv. 2017, 3 (9), e1701879. https://doi.org/10.1126/sciadv.1701879. [3] Guo, Q.; Spitler, C.; Sanghishetty, J. M.; Boyce, C. M. Advances in Vibrated Gas-Fluidized Beds. Current Opinion in Chemical Engineering 2023, 42, 100977. https://doi.org/10.1016/j.coche.2023.100977.