Dynamically Structured Gas-solid Fluidized Bed for Tailored and Intensified Particle Processing

Oscillating the gas flow in specific conditions leads to a new flow regime where gas bubbles form and rise in a regular pattern.

Category
Manufacturing Techniques

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Background

The design and control of fluidized beds used in manufacturing can be challenging and costly. Mixing and heat/mass transfer rates are difficult to predict and control due to phenomena like chaotic bubble flows and channel formation. Current methods attempt to improve mixing through empirical modifications or external stimuli, but they lack reliability and scalability.

This technology addresses these problems by introducing a new flow regime that enables precise control of mixing and gas-solid contact patterns in fluidized beds.

Technology Overview

University College London researchers have demonstrated that oscillating the gas flow in specific conditions leads to a new flow regime where gas bubbles form and rise in a regular pattern. This pattern can be controlled by adjusting oscillation parameters, resulting in different bubble sizes and arrangements, that determine the duration of mixing and the solid-gas contact time.

The design improves mixing by compartmentalizing the process. It eliminates chaotic movement caused by different scales of bubbles and clusters, ensuring that all particles experience the same flow structure repeatedly. Unlike other methods that use pulsation or vibration, this device operates under precise conditions to create uniform bubble sizes and patterns.

See Figure 1 and 2.

Benefits

Dynamically structured fluidized beds offer three advantages over classic units:

• Homogeneity, the design enhances mixing by creating a consistent flow structure, ensuring that all particles have the same history and experience the same conditions.

• Scalability, it can be used with different particle sizes and heights without external support. Modular scale up or reduction is possible using vertical units, facilitating production expansion or variable processing.

• Controllability, the unit introduces active control, allowing customization of bubble size, mixing compartments, and solid-gas interactions.

Applications

The technology enables controlled mixing of powders and homogenization of a fluidized bed with low gas velocity. It is particularly beneficial for processes that require low gas demand, effective control, elutriation, attrition, maldistribution of active components, homogeneity, and stress-driven quality. Some of these processes can be found in:

• Solar collectors

• Irradiated reactors

• Plasma fluidized bed reactors

• Manufacturing of advanced materials

Opportunity

The team is looking for a development partner to support and/or develop prototypes for industrial applications.

Patents

• PCT/GB2021/052620 - Particle processing method

Seeking

- Development partner
- Commercial partner
- Licensing

IP Status

Patented