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Coaches	**Supervisors**	**Funding**
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A combined experimental and numerical study of gas-solid hydrodynamics in a vortex chamber

Aim

This study aims to gain a deep understanding of gas-solid hydrodynamics for the design and optimization of the vortex chamber.

Justification

Chemical reactors have always been considered the heart of chemical process. Therefore, it is of paramount importance to develop new reactors to meet the ever-increasing needs in chemical industries. The gas-solid vortex reactor (GSVR, shown in Figure 1a) that shows enormous potential in process intensification with several drawbacks like large gas consumption can be further advanced by vortex chamber design and optimization. An interesting design, i.e., a blade-driven chamber (Figure 1c) has been proposed and patented, in which a stator-rotor inside the cylindrical chamber is driven by the impact of gas. However, the inherently coupled chamber rotation and gas flow pose a problem for the investigation of gas-solid hydrodynamics, which is an essential step to optimize that chamber.

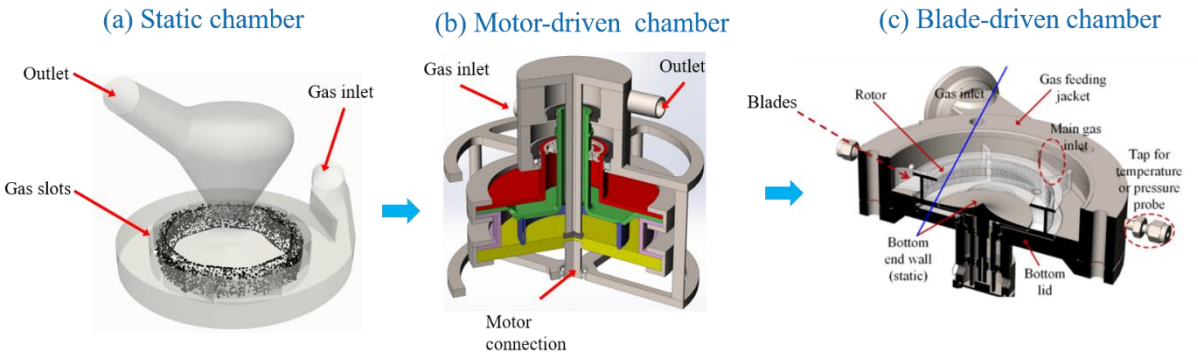

Figure 1. Vortex chamber development path

To bypass this problem, a motor-driven chamber (Figure 1b) was constructed, by which the chamber rotation and gas flow can be decoupled as the chamber can be independently controlled by a motor. Additionally, we believe that the insights of hydrodynamics obtained from the motor-driven chamber will guide the design of the blade-driven chamber.

Program

1. Literature survey on the GSVR, topics e.g., process intensification, geometric design and applications.
2. Experimental work on gas-solid hydrodynamics, important fluidization parameters, e.g., pressure drop, bed height and bed voidage, etc. Particle image velocimetry measurement of particles will also be executed to study the particle flow behavior.
3. Constructing a flow regime map and a pressure drop model, performing CFD (or ANN) simulation.
4. Formulating design guidelines for the blade-driven vortex chamber.

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