EXPERIMENTAL STUDY OF LANCE BUBBLING PHENOMENA

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The submerged lance injection process is widely used in many kinds of reactors in industry, especially in metallurgical converters. This process consists in the injection of a reactive gas through a submerged lance into a liquid bath, as sketched in Figure . Provided that the pressure in the injection system is sufficient, bubbles grow at the tip of the lance, and due to buoyancy, they rise and detach from the lance at a regular rate. The productivity of a reactor is a function of the efficiency of the chemical reaction between the gas and the liquid, which itself is a direct function of the specific surface of bubbles within the bath. Therefore, the frequency and the size of bubbles detaching from the lance exit is a crucial piece of information to characterize the reactor.

In this framework, the determination of the bubbles' frequency and size is crucial , as the determination of the most important parameters that govern the bubbling frequency. The study is limited to the hydrodynamics of the bubbles, the influence of heat transfer and chemical reactions are deliberately omitted.

The effects of the lance diameter, submergence depth and the volume of the injection system on the bubbling frequency are assessed. Air and Helium are used and compared as injection gas. Flow visualization using a high-speed camera is made and compared with the pressure measurements. All the results are compared with the literature.

A new model is proposed for the calculation of the bubbling frequency, using a proposed detachment criterion, found experimentally (Figure 1). The bubbling frequency is correlated with two adimensional geometrical parameters, using the experimental data and the values found in the literature.

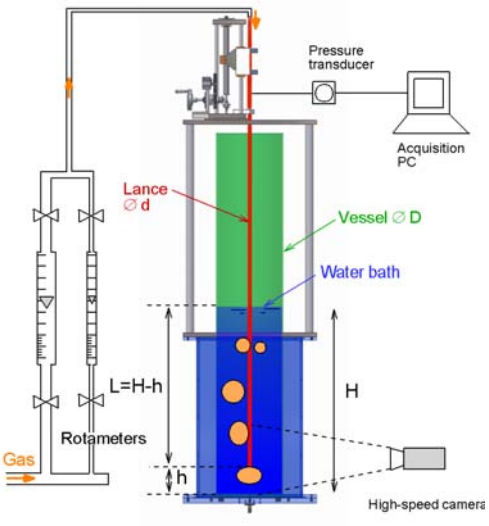

Figure : Submerged lance facility

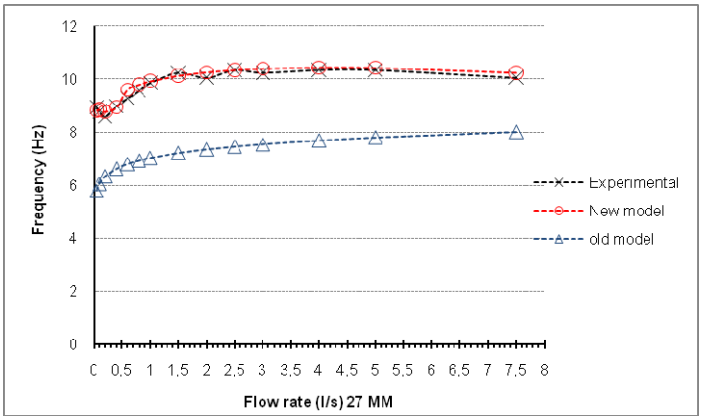

Figure 1: Bubbling frequency as function of flow rate