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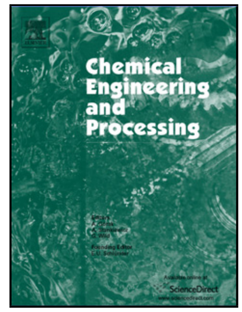

Title: Energy efficiency and performance of bubble generating systems

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Energy efficiency and performance of bubble generating systems

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Highlights

- Design equations for gas and interface output so that targets performance is achieved
- Compare the energy expenditure of each physical processes of bubble generation
- Compare energy efficiency of published bubble generators from literature review
- Measure energy expenditure and interface production of a microscale ejector
- Compare performance of microscale ejector with existing technology
- Identify key physics that enables high energy efficiency and process intensification

Abstract

The energy efficiency of bubble generating systems of gas-liquid contacting reactors is reviewed and analyzed quantitatively. The key metrics that emerge from a new theoretical analysis are: i) gas fraction of the output dispersion (ϵ_{gen}) , ii) interfacial area density of the output dispersion (a_{gen}) , iii) the energy necessary to create interfacial area (ξ), and iv) cost and maintenance. These metrics are then used to create a literature review of the performance of existing technologies for bubble generation. thus producing a conceptual framework for process intensification and future designs for bubble generating systems. A novel micro-ejector device is then studied within this framework, and is found to have desirable performance, hypothetically because it limits fluid shear to be located on at the gas injection site, on micron size scales. A physical model of the gas entrainment and bubble creation mechanisms in the micro-ejector is described and validated with empirical data.