

Bubble size and gas-liquid interfacial area measurements using molten paraffin waxes in bubble columns

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Abstract

Experiments were conducted in 0.05 m ID and 0.23 m ID by 3 m tall bubble columns with different types of molten waxes as the liquid medium and nitrogen as the gas, under processing conditions typical of Fischer-Tropsch synthesis over iron catalysts (i.e. gas velocities up to 0.15 m/s, and temperatures between 200 and 270°C) to estimate gas-liquid interfacial area from measured values of average gas hold-up and Sauter mean bubble diameter. The gas hold-up was estimated from visual observations of the expanded and static liquid heights, and the Sauter was estimated from bubble size measurements obtained by photography and dynamic gas disengagement. The paraffin wax (FT-300) used in the authors' studies is non-coalescing and has a tendency to foam. The amount of foam is greater for runs conducted in the order of increasing gas velocities, than in runs with decreasing velocities. Thus, two values of hold-up are possible and the start-up procedure determines which one will be attained. At higher gas velocities (> 0.05 m/s) the foam disappears and a transition to the slug flow, churn-turbulent regime takes place. Reactor waxes are coalescing in nature and do not produce foam. Despite similar hold-ups for the different waxes at higher gas velocities, the Sauters are significantly different and this is reflected in the specific gas-liquid interfacial areas, with larger values obtained with the paraffin wax compared to values with reactor waxes. « less