Fluidized bed hydrodynamic modelling of CO_2 in syngas: Distorted RTD curves due to adsorption on FCC

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Abstract

The hydrodynamics of gas-phase fluidized beds is non-ideal due to high velocity. Micro-fluidized beds have distinct flow patterns because of the wall and the diameter constrains bubble velocity. We measured the gas phase RTD in a 8 mm ID quartz tube loaded with fluid catalytic cracking catalyst (FCC). We devised a feed manifold to introduce a 4-component tracer gas as a bolus pulse. The FCC separated the gases based on diffusivity like chromatography. At ambient temperature, the trailing edge of CO, CH_4, and CO_2 have extended tails and an axial dispersion model accounts only for 92 % of the variance. We developed a model to characterize the tailing that includes diffusion from the bulk gas to the FCC pores and adsorption-desorption of the gas on the catalyst. This model accounted for 98.6 % of the variance in the RTD. At 300°C the tailing disappeared consistent with expectations in chromatography.

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