Hydrodynamics and gas residence time distribution in a circulating fluidized bed

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The Advanced Catalytic Olefins (ACO) process produces more propylene than conventional naphtha cracking using a circulating fluidized bed (CFB) reactor. Therefore, it is necessary to find the optimum reaction conditions for maximum selectivity of the reaction by measuring gas residence time distribution (RTD). In this study, the effects of gas velocity (2.0-5.0 m/s) and solid circulation rate (0.0-150.0 kg/m2s) on the gas RTD characteristics were determined in a cold model CFB reactor (0.05 m-i.d. × 6.4 m-high) of ACO catalyst (dp = 71 μm, ρs = 1969 kg/m3). The tracer gas (He) was introduced as a pulse injection into a injection nozzle using a solenoid valve. Concentration-time response were recorded to determine the average residence time and to determine Peclet numbers from which the axial dispersion coefficient was determined in the system. The axial dispersion coefficient exhibits a minimum value at the boundary between the fast fluidization and pneumatic conveying flow regimes.