Catalyst performance testing.
Radial and axial dispersion related to dilution in fixed-bed laboratory reactors

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Abstract

The effect of different distributions of catalyst particles and diluent particles on the conversion in gas-solid systems for an irreversible first-order reaction was investigated in a laboratory microreactor. Vertically and horizontally segregated beds, as well as mixed beds were considered. The experimental investigations were performed by employing catalyzed N\textsubscript{2}O decomposition over two different catalysts: FeZSM-5 and Co-La,Al mixed oxide. If the catalyst and the dilution are not well-mixed, the conversion may reduce significantly due to bypassing and axial dispersion. The effects are the strongest at high conversions. Since a completely homogeneous distribution of catalyst and diluent is difficult to achieve, the use of data obtained at high conversions with diluted fixed beds should preferentially be avoided, since it can lead to a wrong interpretation of kinetic data, e.g. the apparent activation energies may vary considerably. The radial and axial dispersion coefficients were estimated from the experiments, all in the laminar-flow regime, using the Random Particle Distribution (RPD) model. The bed tortuosity derived using the model corresponds well with values reported in literature.

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