Heterogeneous Numerical Modelling for the Autothermal Reforming of Synthetic Crude Glycerol in a Fixed Bed Reactor

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Abstract

This paper presents a numerical reactor model for the catalytic autothermal reforming (ATR) reaction of crude glycerol in fixed bed tubular reactor over an in-house developed metal oxide catalyst. The heterogeneous model accounts for a two-phase system of solid catalyst and bulk feed gas developed using finite element method. The reaction scheme and intrinsic kinetic rate model over an active, selective, and stable catalyst were integrated in the developed model. The model was validated using experimental data. The modelling results adequately described the detailed gas product composition and distribution, temperature profiles, and conversion propagation in axial direction of the fixed bed reactor over a wide range of reaction temperature and hourly space velocity. The crude glycerol conversion predicted with the model showing close resemblance to those obtained experimentally with an average absolute deviation of 8%. The maximum conversion and yield were 92% and 3 mol. H2/mol. crude glycerol, respectively.

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