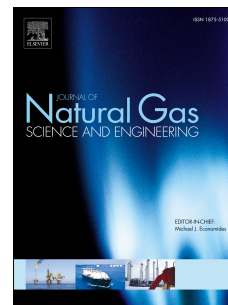


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## Kinetic Study of Reactive Sorption-Enhanced Reforming of Coke Oven Gas for Hydrogen Production

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### Abstract

The kinetic behavior of reactive sorption-enhanced reforming (ReSER) process of coke oven gas (COG) for hydrogen production was investigated. Experimental studies were performed on a laboratory-scale fixed-bed reactor with a Ni-nano-CaO/Al<sub>2</sub>O<sub>3</sub> sorption complex catalyst. Based on hypothesis that the surface reaction of steam methane reforming in the ReSER-COG process is the rate-determining step, a reaction kinetic model of the reforming reaction of the ReSER-COG process was established. The kinetic data of the methane conversion were obtained under a reaction temperature from 560 °C to 680 °C, a residence time of 0.0417-0.0105 g·min·mL<sup>-1</sup>, a steam-to-methane molar ratio of 4, and a reaction pressure of 0.1 MPa. The mean relative deviation of the methane conversion between the data from the simulated model and those from the experiments was determined to be 4.58%, which illustrates a good fit of the established model with the experimental data and confirmed the rationality of the hypothesis that the surface reaction of methane reforming in ReSER-COG process is rate-determining step. The calculation results show that the reforming reaction activation energy in ReSER-COG process is 95 kJ·mol<sup>-1</sup>, nearly 145 kJ·mol<sup>-1</sup> decreased compared with the steam methane reforming without sorption-enhancement. This explains the reason that higher methane conversion rate at a lower reaction temperature observed in the ReSER-COG process.

**Key words:** hydrogen; coke oven gas; reaction kinetics; reactive sorption enhanced reforming; complex catalyst

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