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ENERGY CONVERSION IN WALL CATALYTIC STEAM REFORMING OF HYDROCARBON FUEL AT SUPERCRITICAL PRESSURES

Abstract

The wall catalytic steam reforming is expected to be used in regeneratively cooled scramjet because of its high chemical reaction heat and inhibiting coking. Therefore, a numerical model including chemical reaction mechanism of hydrocarbon fuel was established and validated based on experiments to study the energy conversion in wall catalytic steam reforming (WCSR) of hydrocarbon fuel at supercritical pressures. The numerical results indicated that an inflection point existed in the energy conversion under the coupling influence of endothermic and exothermic reactions in reaction mechanism. The energy conversion increased before the inflection point and decrease after that. Energy conversion was layer distribution in radial direction, and the gradient directions of layer distribution before and after inflection point were different. According to the fundamental numerical study for influence of key parameters on the energy conversion, the results indicated that catalyst layer thickness and residence time were beneficial to enhance the conversion rate of energy before the inflection point, but caused the decrease of energy conversion after inflection point. The energy conversion increased with water content. Being different with thermal pyrolysis, the energy conversion decreased with operation pressure.