Isooctane Reforming in Supercritical Water: A Strategy for High Yield Hydrogen Production

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The high temperature study of isooctane gasification in supercritical water in continuous down-up tubular reactor system has been studied at temperature of 763±2 oC and pressure of 25 MPa. The new reactor material, Haynes® 230® alloy, is introduced. It exhibits excellent strength and long life time at high temperature and pressure compare to Hastelloy C-276 or stainless steel. Various gasification experiments are performed by changing residence time (60-120 s), isooctane concentration (6.3-14.7 wt%), and oxidant concentration with equivalent oxidant ratio (0-0.3). The total gas yield and the hydrogen gas yield increase with an increment in the residence time and achieved the maximum value at residence time of 106 s. The hydrogen gas yield of 12.4 mol/mol isooctane, which is ~50% of the theoretical maximum hydrogen gas yield, was achieved. The increment of concentration and oxidant decreased the hydrogen yield. At this experiment condition (763±2 oC; 25 MPa; 6.3 wt%), supercritical water partial oxidation does not increase the hydrogen gas yield.