Steam reforming of ethanol over Ni-based catalysts: Effect of feed composition on catalyst stability - DTU Orbit (21/01/2019)

**Steam reforming of ethanol over Ni-based catalysts: Effect of feed composition on catalyst stability**

In this work the effects of steam-to-carbon ratio (S/C), and addition of H2 or O2 to the feed on the product yields and carbon deposition in the steam reforming (SR) of ethanol over Ni/MgAl2O4, Ni/Ce0.6Zr0.4O2, and Ni/CoO2 at 600 °C have been investigated. Increasing the S/C-ratio from 1.6 to 8.3 over Ni/MgAl2O4 increased conversion of ethanol as well as the yield of H2, while the carbon deposition and yield of hydrocarbons decreased. Oxygen addition at S/C-ratio of 6 over Ni/MgAl2O4, Ni/Co0.6Zr0.4O2, and Ni/CoO2 increased conversion, decreased the yield of hydrocarbons, and led to a decrease in the carbon deposition. Carbon deposition was almost eliminated over Ni/MgAl2O4 and Ni/Co0.6Zr0.4O2 at an O/C-ratio of roughly 0.8 or higher. The penalty of adding O2 was a decrease in the yield of H2 from 70% at O/C = 0 to 50% at O/C = 0.8–1. A 90 h test at O/C = 1.1, S/C = 6, and 600 °C over Ni/MgAl2O4 showed stable behavior and an average rate of carbon deposition of less than 7 μg C/gCat h. The results indicate that stable operation of ethanol SR is only possible under oxidative conditions.

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