

Fig. 6. Methane (■), CO (▲), and CO₂ (◆) selectivity as function of temperature for S/C 4 in SR of propane (catalyst with 900 cps); symbols: experiment; lines: model predictions.

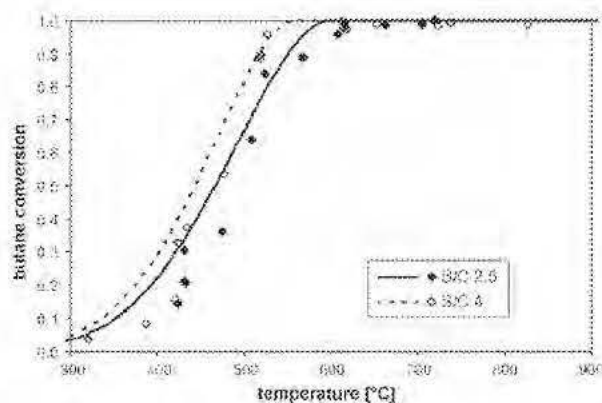


Fig. 7. Butane conversion as function of temperature for varying S/C in SR of butane (catalyst with 900 cps); symbols: experiment; lines: model predictions.

5.5. Natural gas (Nordsee H) feed

The composition of the sulfur-free natural gas (Nordsee H) used in this study is given in Table 4. Steam reforming at S/C ratios of 2.5 and 4 was studied. The conversion of alkanes occurs in two temperature ranges: at temperatures below 400 °C for S/C 4 (450 °C for S/C 2.5) ethane, propane, and butane are almost completely converted (Figs. 8 and 9). Conversion of methane is not observed before the conversion of the higher alkanes is nearly complete. Fig. 10 shows the selectivity for SR of natural gas: methane production is only observed at temperatures below 450 °C with a maximum around 400 °C, CO₂ selectivity rises to nearly 100% at 450 °C and diminishes at higher temperatures where an increasing amount of CO is produced.

Table 4
Composition of natural gas North Sea H.

	vol.%
CO ₂	1.87
N ₂	0.94
O ₂	<0.01
CH ₄	86.72
C ₂ H ₆	8.10
C ₃ H ₈	2.03
C ₄ H ₁₀	0.44
C ₅ H ₁₂	0.07
>C ₅	0.03

Taken from Ruhrgas [34].

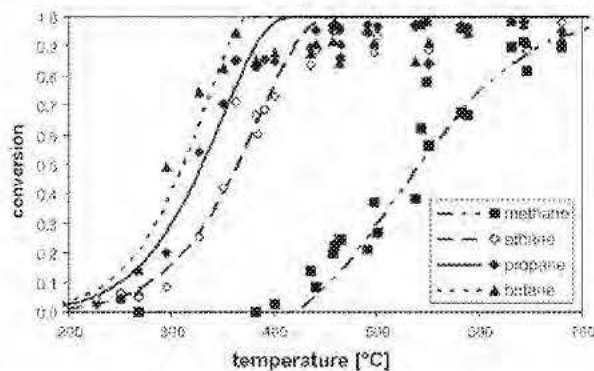


Fig. 8. Methane (■), ethane (○), propane (◆), and butane (▲) conversion as function of temperature for S/C 4 in SR of natural gas (catalyst with 900 cps); symbols: experiment; lines: model predictions.

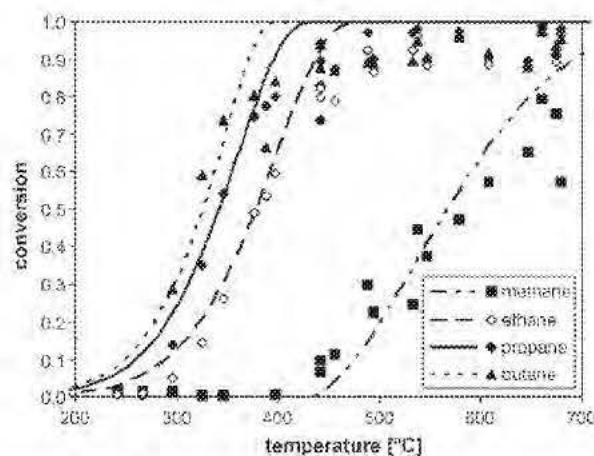


Fig. 9. Methane (■), ethane (○), propane (◆), and butane (▲) conversion as function of temperature for S/C 2.5 in SR of natural gas (catalyst with 900 cps); symbols: experiment; lines: model predictions.

5.6. Conversion in the gas phase

To investigate the significance of gas-phase reactions, experiments with an uncoated honeycomb monolith have been performed. Methane is not converted up to temperatures of 950 °C. Ethane, propane, and butane are converted above 650 °C

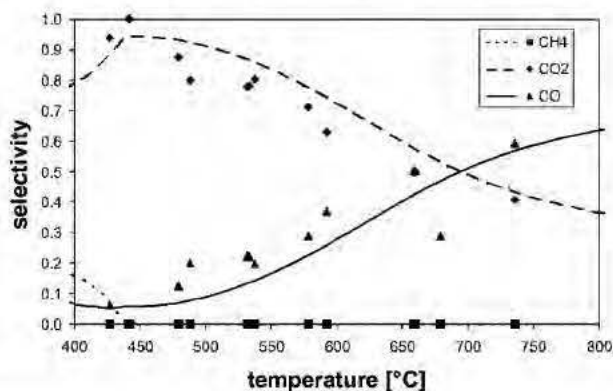


Fig. 10. Methane (■), CO (▲), and CO₂ (◆) selectivity as function of temperature for S/C 2.5 SR of natural gas (catalyst with 900 cps); symbols: experiment; lines: model predictions.