

Hydrogen Production through Methane Catalytic Steam Reforming

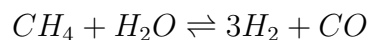
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Background & Description:

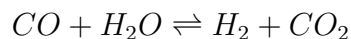
Natural gas has been proposed as a source of hydrogen for fuel cell vehicle applications because of the existing infrastructure. In a process known as steam reforming, natural gas and steam are reacted into mostly carbon monoxide and hydrogen with some carbon dioxide also produced. There can also be excess water in the reformat stream.

A feed consisting of 10000 mol/h CH_4 , 10000 mol/h H_2O , and 100 mol/h H_2 enters into a steam reforming reactor that operates at 1000 K and a 1 atm feed pressure. The reactions taking place in the PFR are as follows:

The steam reforming reaction is given as:



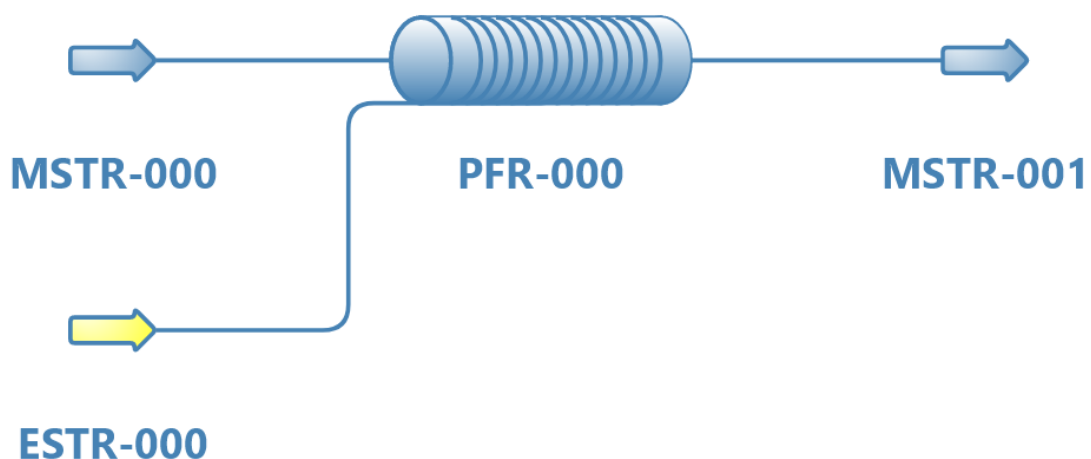
In the steam reformer, the water gas shift reaction also takes place as:

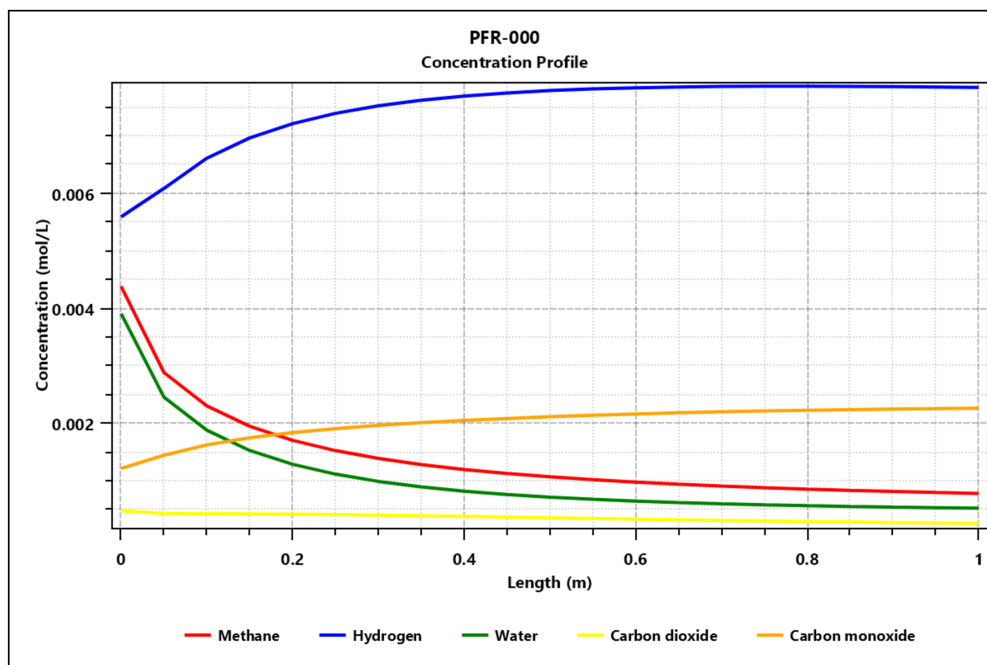


Adding together the steam reforming and water gas shift reactions gives the overall reaction:



In the reactor, methane (CH_4) and water (H_2O) are fed as reactants and carbon dioxide (CO_2), carbon monoxide (CO), and hydrogen (H_2) are produced over a nickel catalyst on an alumina support. The weight of the catalyst is 386 g. The reaction takes place in isothermal mode with reactor volume of 1 m^3 . 75.62% conversion is obtained for methane.





Results:

Object	MSTR-001	MSTR-000	
Temperature	726.85	726.85	C
Pressure	0.96143	1.01325	bar
Mass Flow	340.7791	340.7816	kg/h
Molar Flow	35381.14	20100	mol/h
Volumetric Flow	3060.166	1649.323	m ³ /h

Table 1: Streamwise Results for Hydrogen Production thorough Methane Catalytic Steam Reforming