中文摘要

本研究自行設計建立之甲醇重組器，係針對重組器由部分氧化法切換爲自發熱暫態過程的產氫特性進行實驗研究。實驗參數爲加熱溫度、甲醇進料率、冷起動空氣供應率、O2/C 比與 S/C 比等，探討重組器自發熱暫態產氫特性，使重組器能夠由部分氧化重組法切換自發熱重組法於短時間內產出氫氣，並提升氫氣的產出。

本研究實驗系統主要配置有甲醇燃料與水供應系統、觸媒、溫度控制及氣體成份分析系統等。甲醇經由燃料噴嘴霧化後，導入重組器本體。在進入觸媒之前，先經由加熱器配合甲醇的氧化放熱提升甲醇混合氣溫度，促使觸媒快速產生反應。經重組所得的氣體，需經冷凝器將水蒸汽冷凝，以氣密袋取樣，再以氣密針注入氣相層析儀(GC)進行分析。

本文主要分爲兩部分進行實驗探討，第一部分以研究冷起動特性爲主，採用部分氧化法進行實驗研究，找出冷起動之最佳實驗參數與操作程序；第二部分則以重組器於穩態時期，提高氫氣濃度與產率爲主，所採用之重組方法爲自發熱重組法。根據實驗討論結果得知，甲醇進料率設定於 10 cc/min、加熱溫度 150 oC、冷起動空氣供應率 40 L/min 以及穩態模式切換溫度 150 oC 時，可於最短時間內快速起動。自冷起動開始，氫氣達穩定最大產率所需時間約只要 120 秒；當觸媒出口溫度約 116 oC 左右時，即開始產出氫氣，並約於 370 oC 時達氫氣最大產出濃度約 36.86Vol %，氫氣產出流率約 10.34 L/min。自發熱重組法穩態性能實驗結果得知，於甲醇進料率 25cc/min、S/C 比 2.5 以及 O2/C 比 0.14 時可得最大氫氣產出濃度，約 48.01 Vol %，氫氣產出流率 17.78 L/min。

英文摘要

This study was to design a methanol reformer. The transition of partial oxidation reforming to autothermal reforming of a methanol reformer was investigated. The parameters are heating temperature, fuel supply rate, air supply rate, O2/C ratio and S/C ratio. The main aim of this project is to get the rapid hydrogen production in partial oxidation and autothermal reforming.

The methanol reformer is composed of fuel, air and water injectors, the catalyst, temperature controlling system and gas analysing system. Glow plugs were mounted at the inlet of the catalyst of the reformer to pre-heat and ignite the mixture, and the mixture temperature was well controlled. The produced gases were sampled at the exit of the catalyst.

The experiments in this thesis consist of two main parts. The first, the transient characteristics of a methanol reformer was investigated by partial oxidation reforming. The second, the characteristics of autothermal reforming for increasing hydrogen was investigated.

The results showed that the best response of cold start was at 10 cc/min methanol supply rate, 150oC heating temperature, 40L/min air supply rateand 150oC steady mode shifting temperature. Hydrogen was produced at 116oC of catalyst outlet temperature. Also, the stable H2 production was achieved at about 120 seconds since cold start. The stable consistency of 36.86Vol % H2 production and the flow rate of 10.34 L/min were achieved at the temperature of 370oC. It showed that the best result of autothermal reforming was with 25cc/min methanol supply rate, 2.5 S/C ratio and 0.14 steady mode O2/C ratio. The stable concentration of 48.01 Vol % H2 and 17.78 L/min H2 production rate were obtained.