

常压、脉冲微波强化丝光等离子体作用下甲烷与二氧化碳的反应研究

张军旗,杨永进,张劲松,刘强

中国科学院金属研究所,沈阳(110016)

收稿日期 修回日期 网络版发布日期 接受日期

摘要 采用脉冲微波强化丝光等离子体反应装置,研究了甲烷氧化偶联与二氧化碳重整制合成气(CO+H₂)副产乙炔、乙烯的反应。常压下,当CH₄和CO₂流量分别为 120, 80mL/min, 微波峰值功率120W, 脉冲通断比为100/100ms时, CH₄和CO₂转化率分别为70.8%, 68.8%;CO, C₂H₂, C₂H₄选择性分别为75%, 17.8%和4.1%, 产物中没有积炭。H₂/CO摩尔比值随原料气中甲烷比例的增加而增大, 当CH₄/CO₂摩尔比为2:1时, H₂/CO摩尔比达到2, 这种比例的合成气能方便地用于下一步的 Fischer-Tropsch反应和其他化学品的合成。与其他等离子体反应相比, 采用脉冲强化常规丝光等离子体进行CH₄脱氢偶联与CO₂重整反应, 能量效率明显提高, 这对于促进微波等离子体技术在C1化学中的应用具有重要的意义。

关键词 [氧化](#) [偶联](#) [重整](#) [甲烷](#) [二氧化碳](#) [等离子体](#)

分类号 [0621](#)

Study on the Conversion of CH₄ and CO₂ Using a Pulsed Microwave Plasma under Atmospheric Pressure

Zhang Junqi, Yang Yongjin, Zhang Jinsong, Liu Qiang

Institute of Metal Research, Chinese Academy of Sciences, Shenyang (110016)

Abstract A conventional wire-like plasma enhanced and spread by pulsed microwave was used to study the oxidative coupling and reforming of CH₄ with CO₂ to CO, C₂H₂, C₂H₄ and H₂. Under the conditions of atmospheric pressure, flow rate of 200 mL/min (CH₄/CO₂ = 1.5:1), peak microwave power of 120 W and pulse duty factor of 100/100 ms, conversions of CH₄ and CO₂ were 70.8% and 68.8%, respectively; selectivities of CO, C₂H₂, C₂H₄ were 75%, 17.8% and 4.1%, respectively, and there was no carbon deposits. Ratio of H₂/CO increased with increasing CH₄ concentration in the feed gas, and a H₂/CO ratio of 2 could be obtained at a ratio 2:1 of CH₄ to CO₂, which is acceptable for Fischer-Tropsch and other synthesis processes. The energy efficiency of the pulsed microwave plasma was obviously improved. We suggested that this enhanced pulsed plasma is useful for oxidative coupling and reforming of CH₄ with CO₂ in C1 chemistry.

Key words [OXIDATION](#) [COUPLED](#) [REFORMING](#) [METHANE](#) [CARBON DIOXIDE](#) [PLASMA](#)

DOI:

通讯作者

扩展功能

本文信息

▶ [Supporting info](#)

▶ [PDF\(0KB\)](#)

▶ [\[HTML全文\]\(0KB\)](#)

▶ [参考文献](#)

服务与反馈

▶ [把本文推荐给朋友](#)

▶ [加入我的书架](#)

▶ [加入引用管理器](#)

▶ [复制索引](#)

▶ [Email Alert](#)

▶ [文章反馈](#)

▶ [浏览反馈信息](#)

相关信息

▶ [本刊中 包含“氧化”的 相关文章](#)

▶ 本文作者相关文章

- [张军旗](#)
- [杨永进](#)
- [张劲松](#)
- [刘强](#)