

能源和环境工程

## 电弧等离子体裂解甲烷制乙炔

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摘要

对C-H单相及多相热力学平衡体系进行了比较和计算, 在H/C为4时, 单相体系中乙炔收率最大值为98.6%, 而多相体系中乙炔收率最大值为53.1%。实验考察了影响甲烷转化率、乙炔选择性、乙炔收率以及乙炔能耗的因素, 分析了乙炔收率、浓度、能耗三者的关系。实验结果表明, 随着甲烷进气量的增加, 产品气乙炔等碳氢化合物的浓度逐渐增大, 甲烷转化率、乙炔选择性以及收率呈减小趋势, 乙炔能耗在出现一个最低值后开始增大。当甲烷进气量达到 $4.0 \text{ m}^3 \cdot \text{h}^{-1}$ 时, 得到乙炔能耗的最小值为 $9.68 \text{ kW} \cdot \text{h} \cdot \text{kg}^{-1}$ , 此时乙炔体积分数为11.4%, 乙炔收率为86.2%。淬冷后, 乙炔收率增加的最大幅度为18%, 减小反应气体的停留时间使乙炔收率提高的最大幅度达到55%

关键词

[电弧等离子体](#) [甲烷](#) [乙炔](#) [热力学](#)

分类号

## Methane pyrolysis to acetylene under arc plasma

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### Abstract

A thermodynamic analysis of the homogeneous and heterogeneous equilibrium system of hydrocarbons indicated that, the maximum acetylene yield was 98.6% in homogeneous system and 53.1% in heterogeneous system while H/C was 4. Some factors which affected methane conversion efficiency, acetylene selectivity, acetylene yield and specific energy of requirement (SER) were investigated, and the relationship among the concentration of acetylene, yield and SER was analyzed. The methane conversion efficiency, acetylene selectivity and yield decreased and the concentration of acetylene etc. product gas increased with the increase of methane feeding rate, SER did reach a minimum point and then increased. With  $4.0 \text{ m}^3 \cdot \text{h}^{-1}$  methane feeding rate, minimum SER, concentration of acetylene and yield did reach  $9.68 \text{ kW} \cdot \text{h} \cdot \text{kg}^{-1}$ , 11.4% and 86.2% respectively. The increased maximum extent of acetylene yield approached 18% and 55% respectively by quenching and change of residence time.

### Key words

[arc plasma](#) [methane](#) [acetylene](#) [thermodynamics](#)

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