THERMODYNAMIC PERFORMANCE OF CO_2 REFORMING OF A DC PLASMA JET REATOR

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Thermodynamic performance on synthesis gas preparation from dry reforming of methane by carbon dioxide via DC plasma jet at atmospheric pressure has been studied, and nitrogen gas was used as the working gas to form a plasma jet. In order to obtain higher chemical energy efficiency and fuel production efficiency, as well as higher conversion rate of methane and carbon dioxide, the effect of CH_4/CO_2 molar ratio on the thermodynamic performance of reforming process was studied. Results showed that higher conversion rate of CH_4 and CO_2, higher selectivity of H_2 and CO, higher chemical energy efficiency and fuel production efficiency were achieved using DC plasma jet reactor, in comparison with other non-thermal plasma reactors. When CH_4/CO_2 molar ratio equal to 1, a maximum chemical energy efficiency of 59.8% was obtained, as well as the conversions rate of CH_4 and CO2 were up to 92.2% and 88.3%, respectively, the fuel production efficiency was up to 77.5%.The better performance using DC plasma jet reactor is attributed to the fast molecular dissociation rate under the condition of higher energy density, higher temperature, more free radicals in plasma jet reactor.

Index Terms —DC plasma jet, reforming of methane, carbon dioxide, syngas, thermodynamic performance

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