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STUDY ON PULSED PLASMA ENABLED CH_4 CONVERSION FOR THE PRODUCTION OF VALUED-ADDED CHEMICALS*

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CH_4 is the raw material of carbon-based value-added chemicals and hydrogen carrier. Under the goal of carbon neutralization, it is an urgent need to develop environmental-friendly approaches of CH_4 conversion to platform chemicals at mild condition with high energy and resources utilization efficiency [1-2]. Herein, several highly adjustable pulsed power sources are employed to directly convert the CH_4 into H_2, C_2H_2, syngas and other platform chemicals by CH_4 non oxidation, reforming and partial oxidation processes. A generator characteristics-plasma properties-catalytic surface multiphase interface is proposed to regulate the target reaction pathway, furtherly revealing evolution of transient species and the responding mechanism between discharge and chemical reactions. In situ optical diagnosis, zero dimension kinetic modelling and in-line electrical measurements were used to obtain an integrated insights into the synergetic effect on electron-induced reaction and describe a panorama of plasma contributions. The gas products distribution is found to be highly correlated discharge mode and the pulsed parameters (rising/falling edge, pulse width). In the CH_4 non oxidation process, the highest CH_4 conversion of 91.2% and H_2 yield of 38.4% are achieved with energy efficiency of 44.3% by pulsed spark discharge. In the CH_4 reforming process, a shorter rising time is suggested to contribute both on conversion and energy efficiency.

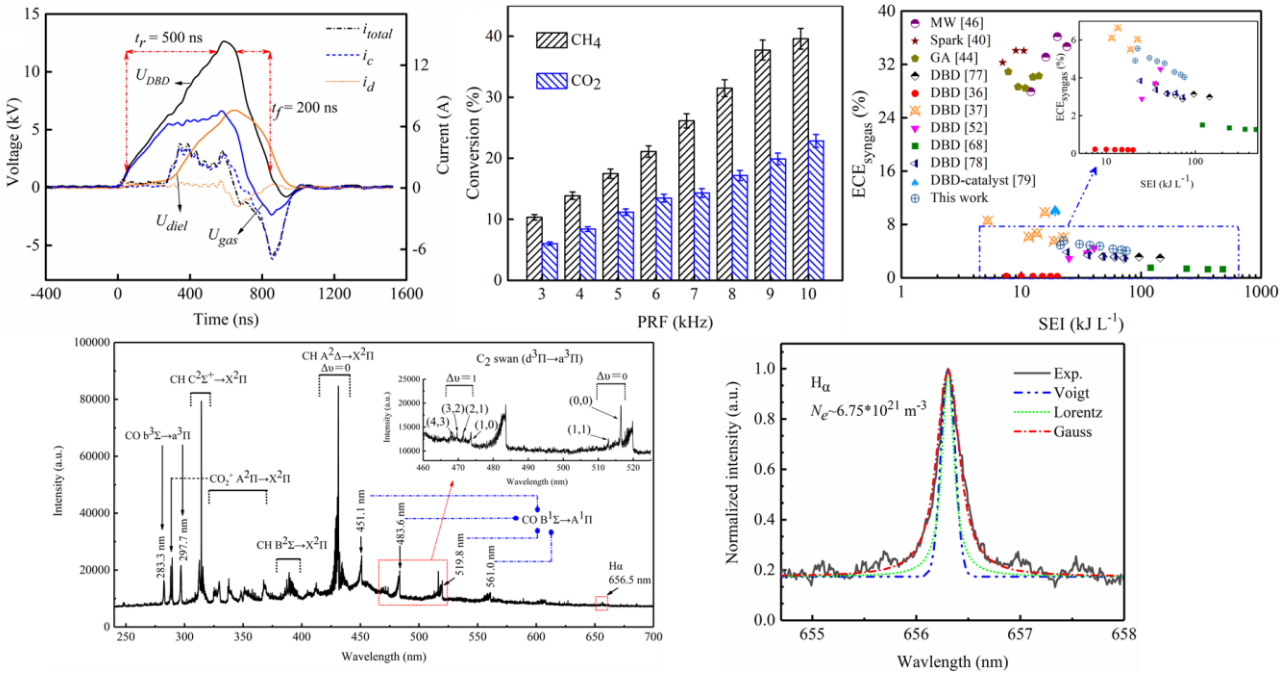

Fig.1. Pulsed plasma enabled CH_4/CO_2 reforming process.

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