Methane-to-Hydrogen Conversion Using Atmospheric Pressure Plasma Reactor with Honeycomb Electrode

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Abstract

This research presents the development of an innovative atmospheric pressure plasma generator for gas conversion using Dielectric Barrier Discharge (DBD) plasma technology. The system incorporates a specialized dielectric design to enhance reaction efficiency and gas conversion. Testing demonstrates high methane conversion efficiency of up to 90% at a flow rate of 60 ml/min, with energy consumption of 852 kWh per kg-Hydrogen at a flow rate of 160 ml/min. The system demonstrates excellent stability with continuous operation over 24 hours under atmospheric conditions. While current energy consumption indicates potential for optimization, the primary focus remains on the technical innovation of the DBD system design, which emphasizes practical applications, scalability, and operational safety under atmospheric pressure conditions. This technological advancement represents a significant step toward environmentally friendly industrial hydrogen production processes, with opportunities for future energy efficiency improvements.

Keywords: Atmospheric pressure plasma, Dielectric Barrier Discharge (DBD), Methane conversion, Honeycomb electrode, Hydrogen production

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Professional Background

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Selected Awards and Honors

1. 2013 Best Magnetized Plasma Poster Award of International Conference on Plasma Science and Applications (ICPSA 2013) at Singapore, December 6, 2013

Selected Publications

1. Puripunyavanich V., Chanchula N., Maikaeo L., Limtiyayothin M., Orpong P., Tamman A., Piriyaphattarakit A. (2023). Effects of Ethyl Methanesulfonate on Mutation Induction in Chrysanthemum spp. Trends in Sciences, 20(12), 6904.
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