

Plasma Catalysis: Opportunities and Challenges in Gas Conversion

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The conversion of inert molecules (e.g., CO₂, CH₄, and N₂) with strong chemical bonds for the synthesis of value-added synthetic fuels and platform chemicals has attracted significant interest. However, the activation of these molecules remains a great challenge due to their thermodynamical stable, requiring a substantial amount of energy for activation. Non-thermal plasma (NTP) has emerged as a promising technology for gas conversions under ambient conditions. The combination of NTP with heterogeneous catalysis has great potential for achieving a synergistic effect through the interactions between the plasma and catalysts, which can activate catalysts at low temperatures, improve their activity and stability, and lead to a notable increase in conversion, selectivity, and yield of end-products, as well as enhance the energy efficiency of the process. Furthermore, plasma processes can be switched on and off instantly, offering great flexibility in decentralised fuel and chemical production using renewable energy sources, particularly intermittent renewable energy. This presentation will discuss the opportunities and challenges in plasma-catalytic gas conversion to fuels and chemicals, including various chemical processes such as CH₄ activation, CO₂ conversion, and ammonia synthesis.

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