

Advanced Energy Materials and Research

Combinedoxidation of methane to synthesis gas

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Background: The combined oxidation of methane (CH₄) and oxygen (O₂) is a complex process involving multiple reaction pathways. The primary reaction is the complete oxidation of methane to carbon dioxide (CO₂) and water (H₂O). However, under certain conditions, partial oxidation can occur, leading to the formation of synthesis gas (CO and H₂). The synthesis gas is a valuable feedstock for various chemical processes, including the Fischer-Tropsch synthesis of liquid fuels and the production of methanol. The study of the combined oxidation of methane is essential for optimizing the production of synthesis gas and understanding the underlying reaction mechanisms. The present work focuses on the experimental investigation of the combined oxidation of methane in a flow reactor. The reaction conditions, including temperature, pressure, and the molar ratio of CH₄ to O₂, were varied to study their effect on the product distribution. The results show that the partial oxidation of methane is favored at lower temperatures and higher CH₄/O₂ ratios. The synthesis gas yield increases with increasing temperature and decreasing CH₄/O₂ ratio. The reaction mechanism is discussed in terms of the relative rates of the various reaction pathways. The study provides valuable insights into the kinetics and thermodynamics of the combined oxidation of methane, which can be used to design more efficient and selective processes for the production of synthesis gas.