

**PARTIAL OXIDATION OF METHANE TO SYNTHESIS GAS IN LOW
TEMPERATURE PLASMAS**

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A Thesis Submitted in Partial Fulfilment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
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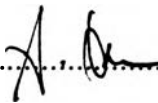
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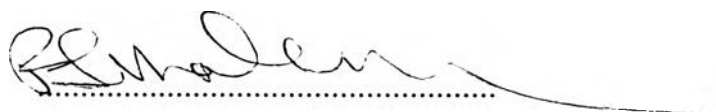
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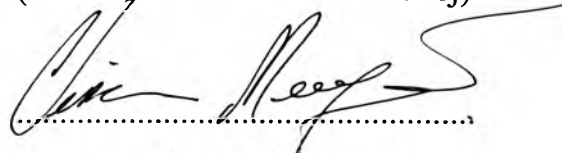
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ABSTRACT

4171006063 : PETROCHEMICAL TECHNOLOGY PROGRAM

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The objective of this study was to investigate a new route for production of synthesis gas from partial oxidation of methane under environment of the AC electric discharges at ambient conditions. It was found that with an increase in voltage, methane and oxygen conversions as well as yields of hydrogen and carbon monoxide increased. The conversions of methane and oxygen, including yields of hydrogen and carbon monoxide decreased with increasing either frequency or flow rate. An increase in methane partial pressure resulted in decreasing the conversions of methane and oxygen. The conversions of methane and oxygen increased, whereas yields of hydrogen and carbon monoxide decreased with the increasing the gap width. The study shows that the maximum yield and selectivity of synthesis gas was approximately 30 % and 55%, respectively. This optimum condition was obtained at applied voltage of 9,000 V, frequency of 300 Hz, flow rate of 100 ml/min and methane to air ratio of 2:4.8. The presence of ethane enhanced the selectivities of both hydrogen and ethylene.

บทคัดย่อ

อริพล เครื่องปอง : การเปลี่ยนแปลงก๊าซมีเทนต่อปฏิกิริยาออกซิเดชันเพื่อผลิตซินทีสิส ก๊าซภายใต้สภาวะพลาสมาที่อุณหภูมิต่ำ (Partial Oxidation of Methane to Synthesis Gas in Low Temperature Plasmas) อ. ที่ปรึกษา : ศ. ริชาร์ด จี แมลลินสัน (Prof. Richard G. Mallinson) และ รศ. สุเมธ ชวเดช เอกสารจำนวน 77 หน้า ISBN 974-334-121-8

วัตถุประสงค์ของงานศึกษานี้เพื่อศึกษาวิธีการใหม่ในการผลิตซินทีสิสก๊าซ (Synthesis gas) จากปฏิกิริยาออกซิเดชันที่ไม่สมบูรณ์ภายใต้สภาวะไฟฟ้าแรงสูงกระแสสลับที่อุณหภูมิต่ำ และความดันบรรยากาศ จากการศึกษาพบว่าเมื่อทำการเพิ่มความต่างศักย์ไฟฟ้าประสิทธิภาพการเปลี่ยนแปลงของก๊าซมีเทนและออกซิเจนสูงขึ้น และประสิทธิภาพการผลิตซินทีสิสก๊าซสูงขึ้นด้วย ประสิทธิภาพการเปลี่ยนก๊าซมีเทนและออกซิเจนรวมตัวประสิทธิภาพการผลิตซินทีสิสก๊าซลดลง เมื่อเพิ่มความถี่หรืออัตราการไหลของก๊าซขาเข้า และเมื่อเพิ่มอัตราส่วนของก๊าซมีเทนในก๊าซขาเข้า พบว่าประสิทธิภาพการเปลี่ยนแปลงของก๊าซมีเทนและออกซิเจนลดลง เมื่อระยะห่างระหว่างลวด อิเล็กโทรดเพิ่มขึ้นทำให้ประสิทธิภาพการเปลี่ยนแปลงของก๊าซมีเทนและออกซิเจนสูงขึ้น แต่ประสิทธิภาพการผลิตซินทีสิสก๊าซลดน้อยลง ผลการทดลองยังแสดงประสิทธิภาพการผลิตสูงสุดและ ประสิทธิภาพการเกิดจำเพาะของซินทีสิสก๊าซประมาณ 30 เปอร์เซ็นต์ และ 55 เปอร์เซ็นต์ ตาม ลำดับ ที่แรงดันไฟฟ้า 9,000 โวลต์, ความถี่ 300 เฮิรซ์ และอัตราการไหลของก๊าซขาเข้า 100 ลูก บาศก์เซนติเมตรต่อนาที ที่อัตราส่วนของก๊าซมีเทนต่อออกซิเจนเท่ากับ 2 : 4.8 เมื่อผสมก๊าซมีเทน ทำให้ประสิทธิภาพการผลิตก๊าซไฮโดรเจนและก๊าซเอทิลีนสูงขึ้น

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