PARTIAL OXIDATION OF METHANE TO SYNTHESIS GAS IN LOW TEMPERATURE PLASMAS

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Thesis Advisors	:	Assoc.Prof. Richard G. Mallinson Assoc.Prof. Sumaeth Chavadej

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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 dicharges 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

อธิพล เครือปอง : การเปลี่ยนแปลงก๊าซมีเทนต่อปฏิกิริยาออกซิเดชั่นเพื่อผลิตซินทีซิสก๊าซภายใต้สภาวะพลาสมาที่อุณหภูมิต่ำ (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

วัตถุประสงค์ของงานศึกษานี้เพื่อศึกษาวิธีการใหม่ในการผลิตซินทีซิสก๊าซ (Synthesis gas) จากปฏิกิริยาออกซิเดชั่นที่ไม่สมบูรณ์ภายใต้สภาวะไฟฟ้าแรงสูงกระแสสลับที่อุณหภูมิห้องและความดันบรรยากาศ จากการศึกษาพบว่าเมื่อทำการเพิ่มความต่างศักย์ไฟฟ้าประสิทธิภาพการเปลี่ยนแปลงของก๊าซมีเทนและออกซิเจนสูงขึ้น และประสิทธิภาพการผลิตซินทีซิสก๊าซสูงขึ้นด้วย ประสิทธิภาพการเปลี่ยนก๊าซมีเทนและออกซิเจนรวมตัวประสิทธิภาพการผลิตซินทีซิสก๊าซลดลง เมื่อเพิ่มความถี่หรืออัตราการไหลของก๊าซขาเข้า และเมื่อเพิ่มอัตราส่วนของก๊าซมีเทนในก๊าซขาเข้า พบว่าประสิทธิภาพการเปลี่ยนแปลงของก๊าซมีเทนและออกซิเจนลดลง เมื่อระยะห่างระหว่างลวดอีเลคโทร์ดเพิ่มขึ้นทำให้ประสิทธิภาพการเปลี่ยนแปลงของก๊าซมีเทนและออกซิเจนสูงขึ้น แต่ประสิทธิภาพการผลิตซินทีซิสก๊าซลดน้อยลง ผลการทดลองยังแสดงประสิทธิภาพการผลิตสูงสุดและประสิทธิภาพการเกิดจำเพาะของซินทีซิสก๊าซประมาณ 30 เปอร์เซ็นต์ และ 55 เปอร์เซ็นต์ ตามลำดับ ที่แรงดันไฟฟ้า 9,000 โวลต์, ความถี่ 300 เฮิร์ซ และอัตราการไหลของก๊าซขาเข้า 100 ลูกบาศก์เซนติเมตรต่อนาที ที่อัตราส่วนของก๊าซมีเทนต่อออกซิเจนเท่ากับ 2 : 4.8 เมื่อผสมก๊าซอีเทนทำให้ประสิทธิภาพการผลิตก๊าซไฮโดรเจนและก๊าซเอทิลีนสูงขึ้น

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