

**METHANE REFORMING WITH CARBON DIOXIDE  
OVER A TUNGSTEN FILAMENT**

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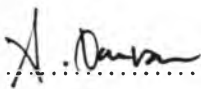
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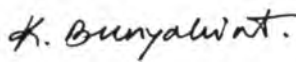
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## ABSTRACT

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Carbon dioxide (  $\text{CO}_2$  ) reforming of methane (  $\text{CH}_4$  ), with assistance of a catalyst, can produce synthesis gas with a low hydrogen (  $\text{H}_2$  ) to carbon monoxide (  $\text{CO}$  ) ratio which is desirable for many industrial processes. Both  $\text{CH}_4$  and  $\text{CO}_2$  contribute to the greenhouse effect. The reforming reaction is therefore important for environmental implications as well. In this study, a tungsten wire having 0.25 mm in diameter and 250 mm in length was used as a catalyst. The wire was placed in a horizontal quartz reactor and heated with DC power in order to raise its temperature. The reactant gases with  $\text{CO}_2/\text{CH}_4$  feed ratios of 0.3-3 were introduced into the reactor for wire temperature range of 863-983 K. It was found that an increase in  $\text{CO}_2/\text{CH}_4$  ratio at a temperature of 983 K resulted in a higher production of CO than that of  $\text{H}_2$ . At the  $\text{CO}_2/\text{CH}_4$  ratio of unity, higher reaction temperatures in the range of 863-983 K yielded higher CO and  $\text{H}_2$  production rates. In addition, the activation energies of CO and  $\text{H}_2$  formation were found to be 56.67 and 53.77 kJ/mol respectively.

## บทคัดย่อ

ไพลิน เกาตระการวิวัฒน์ : การรีฟอร์มก๊าซมีเทนด้วยก๊าซคาร์บอนไดออกไซด์บนเส้นลวด  
ทังสแตน (Methane Reforming with Carbon Dioxide over A Tungsten Filament)  
อ. ที่ปรึกษา : ศ.ดร. เอโดแกน กุลาริ (Prof. Erdogan Gulari) รศ. กัญจนา บุญเกียรติ และ  
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การรีฟอร์มก๊าซคาร์บอนไดออกไซด์ ( $\text{CO}_2$ ) ด้วยก๊าซมีเทน ( $\text{CH}_4$ ) โดยมีตัวเร่งปฏิกิริยา  
เพื่อผลิตก๊าซสังเคราะห์ (Synthesis Gas) ที่มีสัดส่วนของก๊าซไฮโดรเจน ( $\text{H}_2$ ) ต่อก๊าซคาร์บอน-  
มอนอกไซด์ต่ำ เป็นที่ต้องการในอุตสาหกรรมหลายแขนง ยิ่งไปกว่านั้นก๊าซคาร์บอนไดออกไซด์  
และก๊าซมีเทนยังก่อให้เกิดปรากฏการณ์เรือนกระจก (Greenhouse Effect) ดังนั้นปฏิกิริยา  
การรีฟอร์มของก๊าซทั้งสองจึงมีความสำคัญต่อสิ่งแวดล้อมเป็นอย่างมาก งานวิจัยนี้ใช้ทังสแตน  
(Tungsten) ที่มีขนาดเส้นผ่านศูนย์กลาง 0.25 มิลลิเมตร ความยาว 250 มิลลิเมตร เป็นตัวเร่ง  
ปฏิกิริยา ในเตาปฏิกรณ์แบบขนาน (Horizontal Reactor) ที่ทำจากควอร์ตซ์ โดยใช้ไฟฟ้า  
กระแสตรง (DC Power) เพิ่มอุณหภูมิของตัวเร่งปฏิกิริยา สัดส่วนของก๊าซคาร์บอนไดออกไซด์  
ต่อก๊าซมีเทนที่ป้อนเข้าเตาปฏิกรณ์อยู่ในช่วง 0.3-3 ที่อุณหภูมิ 863-983 K

จากการทดลองพบว่า การเพิ่มสัดส่วนของก๊าซคาร์บอนไดออกไซด์ต่อก๊าซมีเทน ที่  
อุณหภูมิ 983 K เกิดก๊าซคาร์บอนมอนอกไซด์ในปริมาณมากกว่าก๊าซไฮโดรเจน และการเพิ่ม  
อุณหภูมิในการทำปฏิกิริยาในช่วงอุณหภูมิ 863-983 K ที่สัดส่วนของก๊าซคาร์บอนไดออกไซด์  
ต่อก๊าซมีเทนเท่ากับหนึ่ง ให้ก๊าซคาร์บอนมอนอกไซด์และก๊าซไฮโดรเจนในปริมาณที่มากขึ้น  
และพบว่าพลังงานกระตุ้น (Activation Energy) ของการเกิดก๊าซคาร์บอนมอนอกไซด์และ  
ก๊าซไฮโดรเจนเท่ากับ 56.67 และ 53.77 กิโลจูลต่อโมลตามลำดับ

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