

**HYDROGEN PRODUCTION FROM OXIDATIVE STEAM REFORMING  
OF METHANOL OVER Au/CeO<sub>2</sub>-ZrO<sub>2</sub> CATALYSTS**

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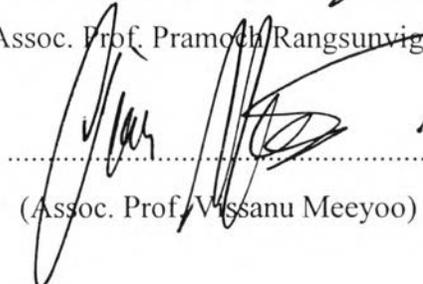
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**ABSTRACT**

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Hydrogen production by oxidative steam reforming of methanol (OSRM) was investigated over Au/CeO<sub>2</sub>-ZrO<sub>2</sub> catalysts prepared by a deposition-precipitation (DP) technique. Pure supports (CeO<sub>2</sub> and ZrO<sub>2</sub>) and mixed supports (CeO<sub>2</sub>-ZrO<sub>2</sub>) were prepared by precipitation and co-precipitation techniques, respectively. A series of Au supported on CeO<sub>2</sub>-ZrO<sub>2</sub> with various atomic ratios of Ce/(Ce+Zr) (0, 0.25, 0.5, 0.75 and 1 ) were studied. The activity was investigated in the range of 200 °C to 400 °C under atmospheric pressure. The 3 wt% Au/Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub> calcined at 400 °C exhibited the highest catalytic activity with 91.28% methanol conversion and 61.50% hydrogen yield at an O<sub>2</sub>/H<sub>2</sub>O/CH<sub>3</sub>OH molar ratio of 0.6/2/1. In addition, it was observed that the 3 wt% Au/Ce<sub>0.75</sub>Zr<sub>0.25</sub>O<sub>2</sub> catalyst showed stable activities for OSRM at 350 °C for 12 hours.

## บทคัดย่อ

วราพรรณ นครานุวัฒน์ : กระบวนการผลิตก๊าซไฮโดรเจนจากปฏิกิริยาเปลี่ยนรูปเมทานอลด้วยไอน้ำและก๊าซออกซิเจนโดยใช้ตัวเร่งปฏิกิริยาทองบนซีเรียออกไซด์และเซอร์โคเนียออกไซด์ (Hydrogen Production from Oxidative Steam Reforming of Methanol over Au/CeO<sub>2</sub>-ZrO<sub>2</sub> Catalysts) อ. ที่ปรึกษา : รศ. ดร. อาภาณี เหลืองนฤมิตชัย และ ศ. ดร. เออร์โดแกน กุลารี่ 122 หน้า

งานวิจัยนี้ศึกษากระบวนการผลิตก๊าซไฮโดรเจนด้วยกระบวนการเปลี่ยนรูปเมทานอลด้วยไอน้ำและก๊าซออกซิเจน โดยใช้ตัวเร่งปฏิกิริยาทองบนตัวรองรับชนิดซีเรียออกไซด์และเซอร์โคเนียออกไซด์ ที่เตรียมด้วยวิธีการยัดเกาะควบคู่กับการตกผลึก (deposition-precipitation) โดยตัวรองรับบริสุทธิ์ (CeO<sub>2</sub> และ ZrO<sub>2</sub>) และตัวรองรับผสม (CeO<sub>2</sub>-ZrO<sub>2</sub>) ถูกเตรียมด้วยวิธีการตกผลึกและการตกผลึกร่วมตามลำดับ สำหรับตัวแปรที่ศึกษากับตัวเร่งปฏิกิริยาทองบนซีเรียออกไซด์และเซอร์โคเนียออกไซด์ เช่น อัตราส่วนโดยโมลของตัวรองรับ (0, 0.25, 0.5, 0.75 และ 1) อุณหภูมิที่ใช้ในการเผาตัวเร่งปฏิกิริยา (calcination temperature) และปริมาณของทองที่ใช้ในการเตรียมตัวเร่งปฏิกิริยา ซึ่งศึกษาความว่องไวในการเกิดปฏิกิริยาในช่วงอุณหภูมิ 200 องศาเซลเซียส ถึง 400 องศาเซลเซียส ภายใต้อุณหภูมิบรรยากาศ ผลการศึกษาแสดงให้เห็นว่าตัวเร่งปฏิกิริยา 3 wt% Au/CeO<sub>2</sub>-ZrO<sub>2</sub> เตรียมที่อุณหภูมิ 400 °C ให้ผลในการเกิดปฏิกิริยาสูงที่สุด โดยพบว่าการเปลี่ยนแปลงของเมทานอล (methanol conversion) มีค่าเป็นร้อยละ 91.28 และผลผลิตไฮโดรเจนร้อยละ (hydrogen yield) มีค่าเป็น 61.50 ยิ่งไปกว่านั้นอัตราส่วนโดยโมลของ O<sub>2</sub>/H<sub>2</sub>O/CH<sub>3</sub>OH ที่ 0.6/2/1 เป็นสภาวะที่เหมาะสมที่สุดต่อการเกิดปฏิกิริยาดังกล่าว นอกจากนี้ยังพบว่าตัวเร่งปฏิกิริยา 3 wt% Au/CeO<sub>2</sub>-ZrO<sub>2</sub> มีความเสถียรในการเกิดปฏิกิริยาสำหรับกระบวนการเปลี่ยนรูปเมทานอลด้วยไอน้ำและก๊าซออกซิเจนที่อุณหภูมิ 350 องศาเซลเซียส เป็นเวลา 12 ชั่วโมง

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