

**HIGH-THROUGHPUT PRIMARY SCREENINGS OF CATALYSTS
FOR CATALYTIC COMBUSTION OF WASTE FLUE GAS FROM
PYROLYSIS PROCESS USING A MULTI-FLOW REACTOR**

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ABSTRACT

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Palladium (Pd) containing catalysts are generally accepted as the most active catalysts commercially available for the oxidation of unsaturated and saturated hydrocarbons with less than five carbon atoms, particularly for methane. Pd/Al₂O₃ is known as an active catalyst for performing the complete oxidation of hydrocarbons. In this work, the addition of promoters, such as Zr, Ti, and Sn to Pd supported on γ -Al₂O₃ in mono-, bi-, and tri-elemental systems, was studied for the activity on methane combustion. The combustion activity was investigated using a multi-flow reactor equipped with gas chromatograph (GC) based on the concept of high throughput screenings. It was found that the catalyst containing 4%Pd, 0.4%Sn, and 0.6%Zr supported on γ -Al₂O₃ gave the highest methane conversion, and the conversion tended to increase with increasing temperature but decrease with increasing time-on-stream. For the library of catalysts supported on γ -Al₂O₃ mixed with 5% ITQ-21, the highest methane conversion was obtained from the one loaded with 4%Pd, 0.6%Sn and 0.4%Zr catalyst. All in all, it was observed that the addition of ITQ-21 into γ -Al₂O₃ as the mixed support can improve the catalyst stability outweighed with the reduction of catalyst activity due to the formation of Pd-ITQ mixed oxide.

บทคัดย่อ

วชนิ เตชะศิริ : การทดสอบความสามารถของตัวเร่งปฏิกิริยาการเผาไหม้ของแก๊สที่เกิดจากกระบวนการเผาไหม้ในกระบวนการไพโรไลซิสโดยวิธีทดสอบแบบไฮทธรูพด้วยเครื่องปฏิกรณ์แบบหลายท่อไหล (High-Throughput Primary Screenings of Catalysts for Catalytic Combustion of Waste Flue Gas from Pyrolysis Process Using a Multi-Flow Reactor) อ. ที่ปรึกษา : ผศ.ดร. ศิริรัตน์ จิตการคำ และ รศ.ดร. สุจิตรา วงศ์เกษมจิต 72 หน้า ISBN 974-9937-83-X

โดยทั่วไปแล้วตัวเร่งปฏิกิริยาที่บรรจุด้วย พัลเลเดียม เป็นที่ยอมรับกันว่าสามารถทำให้สารประกอบไฮโดรคาร์บอนอิ่มตัวและไม่อิ่มตัวที่มีองค์ประกอบของคาร์บอนอะตอมน้อยกว่าห้าอะตอม โดยเฉพาะมีเทนเกิดปฏิกิริยาออกซิเดชันได้ โดยตัวเร่งปฏิกิริยาที่ใช้ในงานวิจัยนี้คือ พัลเลเดียมบนตัวรองรับแกมมา-อะลูมินาที่สามารถช่วยให้ปฏิกิริยาออกซิเดชันของสารประกอบไฮโดรคาร์บอนเกิดได้สมบูรณ์ โดยงานวิจัยนี้เป็นการศึกษาธาตุซึ่งได้แก่ เซอร์โคเนียม ไทเทเนียม และ ทิน ที่เติมลงไปในตัวเร่งปฏิกิริยา ในแบบ องค์ประกอบเดี่ยว และ แบบผสมในระบบสอง และ สามองค์ประกอบ โดยมี พัลเลเดียมบนตัวรองรับ แกมมา-อลูมินา เป็นองค์ประกอบหลัก โดยตัวเร่งปฏิกิริยาทั้งหมดนั้นถูกทดสอบความสามารถในการเกิดปฏิกิริยาโดยใช้เครื่องปฏิกรณ์แบบหลายท่อไหลตามหลักการแบบไฮทธรูพ จากผลการทดลองพบว่า ตัวเร่งปฏิกิริยาแบบหลายองค์ประกอบ ที่ประกอบไปด้วย พัลเลเดียม 4% ทิน 0.4% และ เซอร์โคเนียม 0.6% บนตัวรองรับแกมมา-อะลูมินาให้ความสามารถในการเร่งปฏิกิริยาการเผาไหม้สูงสุด และมีแนวโน้มเพิ่มมากขึ้นเมื่อทำการเพิ่มอุณหภูมิ แต่มีค่าลดลงเมื่อทำการเพิ่มเวลาในการเกิดปฏิกิริยา นอกจากนี้ในงานวิจัยนี้ได้ทำการศึกษาดัชนีที่เป็นการผสมระหว่างแกมมา-อลูมินา และ ไอทิกว-ซีลีนเฮ็ด ซึ่งผลการทดลองที่ได้ปรากฏว่า ตัวเร่งปฏิกิริยาที่ประกอบไปด้วย พัลเลเดียม 4% ทิน 0.6% และ เซอร์โคเนียม 0.4% ให้ความสามารถในการเร่งปฏิกิริยาการเผาไหม้ของตัวเร่งปฏิกิริยาสูงที่สุด จากผลการทดลองดังกล่าวน่าจะเกิดจากการกระจายตัวอย่างดีของ พัลเลเดียมออกไซด์ และการเกิดการรวมตัวเป็นออกไซด์ผสมกับไอทิกว-ซีลีนเฮ็ด ซึ่งอาจทำให้ความสามารถในการเผาไหม้ของตัวเร่งปฏิกิริยาลดลง

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