

**COMPARISON OF SINGLE-WALL CARBON NANOTUBES PREPARED  
BY CATALYTIC DECOMPOSITION OF METHANE AND  
DISPROPORTIONATION OF CARBON MONOXIDE OVER DIFFERENT  
CATALYSTS**



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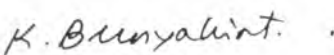
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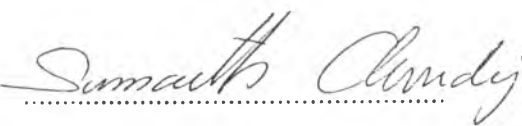
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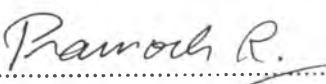
  
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**ABSTRACT**

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Single-wall carbon nanotubes (SWNT) exhibit outstanding mechanical and electrical properties, which can be utilized for various potential applications. Currently, the catalytic decomposition of carbon-containing gases is the most promising pathway for the large-scale production of SWNT. Consequently, in order to produce high quality and quantity of SWNT, carbon-containing gases, catalyst formulations, as well as synthesis conditions have been studied. In this work, methane, carbon monoxide, and their mixtures were systematically tested over a series of Ni-Mo, Co-Mo, and Fe-Mo catalysts supported on silica gel, magnesium oxide and alumina. Raman spectroscopy, temperature programmed oxidation and transmission electron microscopy were used to characterize the deposited carbon on the catalysts. The results showed that CO yielded high quality of SWNT on all supports except on MgO, while methane gave high amounts of deposited carbon but low selectivity towards SWNT. Characterization results also suggested that CO and CH<sub>4</sub> react independently when used in combination.

## บทคัดย่อ

ธีระกุล บุญพวง: การเปรียบเทียบคาร์บอนนาโนทิวป์ประเภทผนังชั้นเดียวที่เตรียมโดยการสลายตัวของก๊าซมีเทนและก๊าซคาร์บอนมอนอกไซด์บนตัวเร่งปฏิกิริยาชนิดต่างๆ (Comparison of Single-Wall Carbon Nanotubes Prepared by Catalytic Decomposition of Methane and Disproportionation of Carbon Monoxide over Different Catalysts)

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คาร์บอนนาโนทิวป์ประเภทผนังเดี่ยว (Single-wall carbon nanotubes) แสดงสมบัติที่โดดเด่นทั้งทางเชิงกลและไฟฟ้า ซึ่งมีความเป็นไปได้ในการนำไปใช้งานที่หลากหลาย การสลายตัวโดยใช้ตัวเร่งปฏิกิริยาของก๊าซที่มีคาร์บอนเป็นวิธีที่มีประสิทธิภาพที่สุดในขณะนี้ในการผลิตคาร์บอนนาโนทิวป์ประเภทผนังเดี่ยว (SWNT) ในปริมาณสูง ด้วยเหตุนี้เพื่อที่จะผลิต SWNT ให้ได้ทั้งคุณภาพและปริมาณที่สูง ก๊าซที่มีคาร์บอนเป็นองค์ประกอบ, องค์ประกอบของคาทาลิสต์ และ สภาพะของการสังเคราะห์ได้ถูกนำมาศึกษา ในงานวิจัยนี้ก๊าซคาร์บอนมอนอกไซด์ ก๊าซมีเทน และก๊าซผสมระหว่างก๊าซคาร์บอนมอนอกไซด์และมีเทน ได้ถูกนำมาทดสอบบนกลุ่มของคาทาลิสต์ นิกเกิล-โมลิบดีนัม, โคบอลต์-โมลิบดีนัม และเหล็ก-โมลิบดีนัม บนตัวรองรับซิลิกา แมกนีเซียมออกไซด์ และอลูมินา การวิเคราะห์คาร์บอนที่สะสมบนคาทาลิสต์นั้นใช้เครื่องมือรามานสเปกโทรสโกปี, temperature programmed oxidation และ กล้องจุลทรรศน์อิเล็กตรอนแบบส่องผ่าน ผลการทดลองนั้นแสดงว่า การใช้ก๊าซคาร์บอนมอนอกไซด์ สามารถให้ SWNT คุณภาพสูงบนทุกตัวรองรับยกเว้นบนตัวรองรับแมกนีเซียมออกไซด์ ในขณะที่ก๊าซมีเทนให้ปริมาณคาร์บอนที่สะสมในปริมาณสูงแต่ให้ผลเลือกที่เป็น SWNT ต่ำ ผลของการวิเคราะห์ชี้ว่าเมื่อป้อนก๊าซคาร์บอนมอนอกไซด์และมีเทนพร้อมกัน ก๊าซทั้งสองทำปฏิกิริยากับคาทาลิสต์โดยอิสระจากกัน

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