

**FORMATION OF TITANIA ULTRATHIN FILM ON NONPOROUS
SUBSTRATE THROUGH ADMICELLAR POLYMERIZATION
TECHNIQUE**

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ABSTRACT

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Keywords : titania ultrathin film/ admicellar polymerization/ nonionic surfactant template/ atomic force microscope/ titanium(IV)butoxide/ titanium(IV)isopropoxide

Titania ultrathin films were fabricated via the admicellar polymerization of inorganic precursors. Thin films of titania were synthesized by admicellar polymerization of titanium alkoxides, *i.e.* titanium(IV)isopropoxide and titanium(IV)butoxide, in adsorbed aggregates (admicelles) of Triton X-100 nonionic surfactant on a nonporous mica substrate. The effects of reaction time, and type and concentration of titanium alkoxide were studied. The titania thin films were characterized by tapping-mode atomic force microscopy (AFM). The results from energy dispersive X-ray spectrometer (EDS) analysis showed evidence of titanium on the mica surface while the results from AFM showed that Triton X-100 appears to help the titania particles adhere to the mica as well as retard the rate of hydrolysis of the precursors. Reaction time and titanium alkoxide precursor concentration were key factors for producing homogeneous and smooth titania films. At 10 minutes reaction time titania films had already begun to form. Heterogeneous titania films were formed when using high concentrations of precursor. Evidence concerning the growth rate of the titania particles indicated that they were formed on the substrate following adsolubilization of the precursors, and not in the bulk.

บทคัดย่อ

มาลัย เงินทวีคุณ: การสังเคราะห์ฟิล์มไททาเนียแบบบางพิเศษบนแผ่นรองรับไร้รูพรุน โดยเทคนิคแอคไมเซลลาร์พอลิเมอไรเซชัน (Formation of Titania Ultrathin Film on Nonporous Substrate through Admicellar Polymerization Technique) อ. ที่ปรึกษา: รศ. ดร. จิตนา สายวรรณ และ รศ. ดร. จอห์น เอช โอเฮเวอร์ 47 หน้า ISBN 974-17-2284-2

ฟิล์มไททาเนียแบบบางพิเศษสามารถสังเคราะห์ได้โดยใช้เทคนิคแอคไมเซลลาร์พอลิเมอไรเซชันจากสารตั้งต้นอนินทรีย์ เทคนิคนี้เป็นเทคนิคใหม่และทำทาทาที่สามารถใช้สังเคราะห์ฟิล์มไททาเนียแบบบางพิเศษโดยใช้สารไททาเนียมแอลคอกไซด์ เช่น ไททาเนียมเตตระบิวทอกไซด์ และ ไททาเนียมเตตระไอโซโพรพอกไซด์ในแอคไมเซลของสารละลายไตรดोनอีทซ์ 100 บนไมคาซึ่งเป็นแผ่นรองรับไร้รูพรุน ตัวแปรที่ศึกษาได้แก่ เวลาที่ใช้ในการเคลือบผิว ชนิดและความเข้มข้นของไททาเนียมแอลคอกไซด์ ฟิล์มไททาเนียแบบบางพิเศษที่ได้จะนำไปศึกษาโครงสร้างของพื้นผิวโดยใช้เครื่องอะตอมมิกฟอร์ซไมโครสโคปชนิดแท่งปิ้งผลการวิเคราะห์พื้นผิวโดยเครื่องอีดีเอสพบว่า มีไททาเนียมอยู่บนพื้นผิว ในขณะที่ผลจากเครื่องอะตอมมิกฟอร์ซไมโครสโคปพบว่า ไตรดोनอีทซ์ 100 ช่วยทำให้อนุภาคไททาเนียเกาะติดอยู่บนไมคาได้ดีขึ้น ปัจจัยสำคัญที่ทำให้ได้ฟิล์มไททาเนียแบบบางพิเศษที่มีความเป็นเนื้อเดียวกันและเรียบได้แก่ เวลาที่ใช้เคลือบผิวและความเข้มข้นของสารตั้งต้นของไททาเนียม ฟิล์มไททาเนียสามารถสังเคราะห์ขึ้นตั้งแต่เวลาในการเคลือบผิว 10 นาที สารตั้งต้นที่มีความเข้มข้นสูงมากจะมีผลทำให้ได้ฟิล์มไททาเนียแบบบางพิเศษที่มีพื้นผิวที่ไม่มีความเป็นเนื้อเดียวกัน จากผลการทดลองศึกษาอัตราการโตของอนุภาคของไททาเนียแสดงว่าฟิล์มไททาเนียแบบบางพิเศษที่สังเคราะห์ได้เป็นฟิล์มที่เกิดจากการที่สารตั้งต้นเกิดแอคโซลูบิไลเซชันเข้าไปในแอคไมเซลของไตรดोनอีทซ์ 100 แล้วจึงเกิดปฏิกิริยา

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