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SYNTHESIS OF Fe-SBA-15 MESOPOROUS MATERIAL

Mr. Kullatat Suwatpipat

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By	Mr. Kullatat Suwatpipat
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.... Dean of the Faculty of Science
(Professor Piamsak Menasveta, Ph.D.)

THESIS COMMITTEE

.... Chairman
(Associate Professor Sirirat Kokpol, Ph.D.)

.... Thesis Advisor
(Aticha Chaisuwan, Ph.D.)

.... Member
(Aroonsiri Shitangkoon, Ph.D.)

.... Member
(Assistant Professor Nongnuj Mungsin, Ph.D.)

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วัสดุที่มีรูพรุนขนาดกลางชนิดใหม่นั่นคือ ไอร์ออน-เอสบีเอ-15 ถูกสังเคราะห์โดยวิธีไฮโดรเทอร์มอลแบบนิ่งที่อุณหภูมิ 100 องศาเซลเซียส ได้ศึกษาระเบียบวิธีสำหรับไอร์ออน-เอสบีเอ-15 ได้ศึกษาผลของพีเอชของเจล (-0.30 ถึง 0.30) ชนิดของเหล็กที่ใช้ (เหล็ก(II) และเหล็ก (III)) และอัตราส่วนซิลิกอนต่อเหล็กในเจล (180 และ 90) ต่อการเกิดโครงสร้าง ไอร์ออน-เอสบีเอ-15 โดยใช้เทคนิคการเลี้ยวเบนของรังสีเอ็กซ์ตรวจสอบโครงสร้าง กล้องจุลทรรศน์อิเล็กตรอนแบบส่องกราดสำหรับศึกษาสัณฐานของผลึก และอิเล็กตรอนสปินเรโซแนนซ์สำหรับศึกษาโคออร์ดิเนชันของเหล็ก พบว่าการบ่มเจลเป็นขั้นตอนที่จำเป็นเพื่อเหนี่ยวนำให้เกิดโครงสร้างของไอร์ออน-เอสบีเอ-15 แบบเฮกซาโกนัลและต้องมีการผสมสารตั้งต้นเหล็กและสารตั้งต้นซิลิกาในสารละลายกรดก่อนเพื่อทำให้เหล็กอยู่ในเฟรมเวิร์คของเอสบีเอ-15 พบสัณฐานของ ไอร์ออน-เอสบีเอ-15 เป็นรูปคล้ายเส้นเชือกและคล้ายตัวหนอนขึ้นกับค่าพีเอชของเจลที่ใช้ในการสังเคราะห์ พบว่าโคออร์ดิเนชันของอะตอมของเหล็กเป็นแบบเททระฮีดรัลและออกตะฮีดรัลกับซิลิกาที่เป็นเฟรมเวิร์ค เหล็กสามารถถูกจับไว้ได้มากขึ้นเมื่อเพิ่มค่าพีเอชของเจล แต่ไม่มีความแตกต่างอย่างเป็นนัยสำคัญในการใช้เหล็ก (II) และเหล็ก (III) เป็นสารตั้งต้น พบว่าวัสดุไอร์ออน-เอสบีเอ-15 ที่สังเคราะห์ได้ในงานนี้มีฤทธิ์ในการเปลี่ยนเมทานอลเป็นไฮโดรคาร์บอนได้ การเกิดผลิตภัณฑ์ประเภทโอเลฟิน เกิดได้ดีที่อุณหภูมิ 300 องศาเซลเซียส ขณะที่การเกิดมีเทนจะเด่นมากขึ้นที่อุณหภูมิสูงขึ้น

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A new mesoporous material, namely Fe-SBA-15, was synthesized by static hydrothermal method at the temperature of 100 °C. The methodology for synthesis of Fe-SBA-15 was studied. Effect of pH of gel (-0.30 to 3.0), type of iron source (Fe^{2+} and Fe^{3+}), and Si/Fe ratio in gel (180 and 90) on formation of Fe-SBA-15 structure were studied. XRD was used for structural determination, SEM for crystal morphology, and ESR for iron coordination. It was found that gel aging is an essential step to induce the hexagonal structure of SBA-15 and the pre-mixing of iron source and silica source in acid solution is required to incorporate iron into the framework of SBA-15. Morphology of Fe-SBA-15 was found to be rope-like and worm-like shape depending on the pH of the synthesis gel. Tetrahedral and octahedral coordinations of iron atoms to framework silica were observed. Iron can be incorporated at higher amount with increasing pH of gel. There was no significant difference in using Fe^{3+} and Fe^{2+} as iron source. The Fe-SBA-15 material synthesized in this work is found active for conversion of methanol to hydrocarbons. Formation of olefinic products is favored at the temperature of 300 °C while formation of methane is more predominant at higher temperature.

Department........Chemistry............................Student's signature.K. Suwatpipat.......

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LIST OF ABBREVIATIONS

AAS	=	Atomic Absorption Spectrometer
ESR	=	Electron Spin Resonance
Fe-SBA-15	=	Iron incorporated SBA-15 structure
GC	=	Gas Chromatograph or Gas Chromatography
GHSV	=	Gas–Hourly Space Velocity
MTO	=	Methanol to Olefins
SEM	=	Scanning Electron Microscope
TOS	=	Time on Stream
XRD	=	X-ray Diffraction or Diffractometer
MFI	=	Mobil Five
SBA-15	=	Santabarbara-15