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THE CONVERSION OF METHANOL TO GASOLINE OVER
VANADOSILICATE CATALYSTS

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บทคัดย่อ

วิทยานิพนธ์นี้เป็นการศึกษาวิธีการเตรียมตัวเร่งปฏิกิริยาอานาโตซีลเคท เพื่อใช้ในการเปลี่ยนเมทานอลให้เป็นแก๊สไฮโดรเจนที่ความดัน 1 บรรยากาศ ซึ่งในการศึกษาครั้งนี้ได้เตรียมตัวเร่งปฏิกิริยาอานาโตซีลเคทที่อัตราส่วนทางประจุของซิลิคอนต่ออานาโตซีลเคทต่าง ๆ คือ อินฟิไนต์, 3,200, 1,600, 400, 90 และ 40 ทั้งนี้ตัวเร่งปฏิกิริยาเหล่านี้ได้ถูกทำการทดสอบเพื่อหาสภาวะการทำงานที่เหมาะสม โดยการแปรเปลี่ยนค่าของตัวแปรต่างๆ เช่น ความเร็วเชิงเส้นเปซ (ระหว่าง 500 ถึง 8,000 ต่อ ชั่วโมง) อุณหภูมิของปฏิกิริยา (ระหว่าง 260 ถึง 420 องศาเซลเซียส) และความเข้มข้นของเมทานอล (ระหว่าง 5 ถึง 100 เปอร์เซ็นต์) นอกจากนี้ได้ทำการตรวจวัดหาความสัมพันธ์ระหว่างคุณสมบัตินี้ทางกายภาพกับพฤติกรรมทางความเร่งปฏิกิริยาของตัวเร่งปฏิกิริยาสังเคราะห์เหล่านี้ จากผลการทดสอบและการตรวจวัดพบว่า ในอัตราส่วนทางประจุที่เหมาะสมระหว่างซิลิคอนต่ออานาโตซีลเคท ตัวเร่งปฏิกิริยาอานาโตซีลเคท จะมีคุณภาพในการเปลี่ยนเมทานอลเป็นแก๊สไฮโดรเจนได้ดีกว่าตัวเร่งปฏิกิริยา ZSM-5

Thesis Title The Conversion of Methanol to Gasoline over
 Vanadosilicate Catalysts

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ABSTRACT

The purpose of this study was to determine a preparation method of vanadosilicate catalysts which could be used for a Methanol to Gasoline (MTG) Conversion process at atmospheric pressure. For this purpose, vanadosilicate catalysts which had Si/V charged ratios of ∞ , 3200, 1600, 400, 90 and 40 were prepared.

These catalysts were tested to determine the optimum condition for activity and selectivity i.e. the gasoline fraction range of C_5 to C_{11} by vavying the following operating parameters: Space Velocity (SV) (from 500 to 8,000 h^{-1}), reaction temperature (from 260 to 420 $^{\circ}C$), MeOH concentration (from 5 to 100%). Relation between physical properties and the catalytic performance of these synthetic catalysts was examined. The results showed that in the suitable range of 3200 to 400, Si/V charged ratio, vanadosilicate catalysts have higher activity and selectivity for MTG than ZSM-5 catalyst.



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NOMENCLATURES

| | | |
|-----------------------------|---|--|
| MTG | = | Methanol to gasoline |
| BET | = | Brunauer Emmett Teller surface area value |
| TPD(NH ₃) | = | Temperature program of desorption of NH ₃ |
| A.A. | = | Atomic Absorption Analysis |
| SEM | = | Scanning Electron Microscope |
| ZSM-5 | = | a zeolite catalyst which synthesized by Mobil Oil company (Zeolite socolony of Mobil Oil Co-5) |
| XRD | = | X-ray Diffraction |
| M | = | Metal |
| n | = | number of electrical charge of metal |
| x | = | stoichiometric number |
| p | = | vapour pressure of MeOH |
| A, B, C | = | arbitrary constant of Antonie's equation |
| t | = | temperature, °C |
| T | = | location of metal ion in framework crystal |
| P _o | = | saturated vapoor pressure of N ₂ |
| SV | = | space vclocity, h ⁻¹ |
| ITG | = | integrating area, unit |
| DME | = | dimethyl ether |
| STY _i | = | space time yield of i products. |
| C ₅ ⁺ | = | hydrocarbons which have C-atom \geq 5 atoms |
| C ₄ ⁻ | = | hydrocarbons which have C-atom \leq 4 atoms |