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SYNTHESIS AND CHARACTERIZATION OF HYPERBRANCH POLYETHER ON POLYIMIDE

Miss Bongkoch Somboonsub

A Thesis Submitted in Partial Fulfillment of the Requirements
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By	Miss Bongkoch Somboonsub
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Thesis Advisor	Associate Professor ML. Supakanok Thongyai, Ph.D.

Accepted by the Faculty of Engineering, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master 's Degree

.... Dean of the Faculty of Engineering

(Professor Direk Lavansiri, Ph.D.)

THESIS COMMITTEE

.... Chairman

(Associate Professor Suttichai Assabumrungrat, Ph.D.)

.... Thesis Advisor

(Associate Professor ML. Supakanok Thongyai, Ph.D.)

.... Member

(Associate Professor Seeroong Prichanont, Ph.D.)

.... Member

(Assistant Professor Bunjerd Jongsomjit, Ph.D.)

Sirirat Wacharawichanant

.... Member

(Sirirat Wacharawichanant, Ph.D.)

บงกช สมบูรณ์ทรัพย์: การสังเคราะห์และวิเคราะห์คุณลักษณะของไฮเปอร์บรานซ์พอลิอีเทอร์บนพอลิอิไมด์ (SYNTHESIS AND CHARACTERIZATION OF HYPERBRANCH POLYETHER ON POLYIMIDE) อาจารย์ที่ปรึกษา: รศ. ดร. มล. ศุภกนก ทองใหญ่, 90 หน้า

ไฮเปอร์บรานซ์พอลิอิไมด์-พอส (พอลิฮีดรอล โอลิโกเมอริก ซินซิสควิออกเซน) คอมโพสิท ถูกสังเคราะห์โดยปฏิกิริยาของโบรไมด์-ไฮเปอร์บรานซ์พอลิอีเทอร์-พอส และพอลิอิไมด์ที่ประกอบด้วยหมู่ไฮดรอกซิล ไฮเปอร์บรานซ์พอลิอีเทอร์เตรียมโดยปฏิกิริยาของ 3,5 ไดไฮดรอกซีเบนซิลแอลกอฮอล์ และโมโนคลอโรไอโซบิวทิลพอส (พอส-คลอรีน) โดยชั้นที่ 2 จะเปลี่ยนปลายไฮดรอกซิลเป็นโบรไมด์ด้วยคาร์บอนเตตระโบรไมด์ และนำพอลิเมอร์ที่ได้ทำปฏิกิริยาซ้ำด้วยแอลกอฮอล์โดยวิธีเดิมเพื่อทำเป็นชั้นที่ 3 การวิเคราะห์ทางความร้อนของฟิล์มไฮเปอร์บรานซ์พอลิอิไมด์ มีอุณหภูมิของการสลายตัวอยู่ระหว่าง 265 ถึง 359 องศาเซลเซียส เช่นเดียวกับค่าอุณหภูมิที่เปลี่ยนสถานะคล้ายแก้วของฟิล์มไฮเปอร์บรานซ์พอลิอิไมด์ที่มีค่า 324.64 องศาเซลเซียส ผลการวัดค่าคงที่ไดอิเล็กทริค พบว่า เมื่อใส่พอสในปริมาณเท่ากัน ในชั้นที่สูงกว่าจะมีค่าคงที่ไดอิเล็กทริคต่ำกว่า ถึงแม้ว่าจะลดปริมาณพอสลง 4 เท่า พอลิอิไมด์ชั้นที่ 3 ก็ยังคงมีค่าคงที่ไดอิเล็กทริคต่ำที่สุด ค่าคงที่ไดอิเล็กทริคต่ำที่สุดมีค่า 2.54 พบในชั้นที่ 3 ของไฮเปอร์บรานซ์พอลิอิไมด์-พอส คอมโพสิท เนื่องจากการมีช่องว่างจำนวนมากภายในโครงสร้างและการยึดเกาะกันหลวมๆ ความหนาแน่นมีผลสอดคล้องกับค่าคงที่ไดอิเล็กทริค คือ ความหนาแน่นที่ต่ำ, ช่องว่างภายในโครงสร้างมาก จะมีค่าคงที่ไดอิเล็กทริคต่ำด้วย จากผลการทดลองพบว่าไฮเปอร์บรานซ์พอลิอิไมด์-พอส คอมโพสิท แสดงสภาพการละลายที่เพิ่มขึ้นเมื่อเทียบกับพอลิอิไมด์ทั่วไป

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ลายมือชื่อนิสิต บงกช สมบูรณ์ทรัพย์

ลายมือชื่ออาจารย์ที่ปรึกษา

4870353921: MAJOR CHEMICAL ENGINEERING

KEY WORD: POLYIMIDE, POLYIMIDE/POSS, LOW DIELECTRIC CONSTANT , HYPERBRANCH POLYETHER

BONGKOCH SOMBOONSUB: SYNTHESIS AND CHARACTERIZATION OF HYPERBRANCH POLYETHER ON POLYIMIDE. THESIS ADVISOR: ASSOC. PROF. ML. SUPAKANOK THONGYAI, Ph.D.,90 pp.

A hyperbranch polyimide-POSS (Polyhedral Oligomeric SilSesquioxanes) composite was synthesized by a reaction of a bromide-hyperbranch polyether-POSS and a polyimide containing hydroxyl functional group. Hyperbranch polyether was prepared by a reaction of 3,5-dihydroxybenzyl alcohol and MonoChloroIsobutyl-POSS (POSS-Cl) and then convert end chain hydroxyl group to bromide by carbontetrabromide for the formation of the second layer and the obtained polymer was repeated reacted with the alcohol with same procedure for the formation of the third layer. Thermogravimetric analysis indicated that the thermal degradation (T5%) of hyperbranch polyimide films occurs at 265 to 359 ^{o}C. The glass transition temperatures of hyperbranch polyimide films are in the range of 324.64^{o}C. Regardless of the fixed amount of POSS, the higher layers yield lower dielectric constant and even reduced four times amount of POSS, the third layer still have the lowest dielectric constants. The lowest dielectric constant value for 2.54 can found in third layer of hyperbranch polyimide-POSS composite due to many free volume and loose polyimide structure. The densities of the hyperbranch polyimide correspond to the dielectric constants. The lower is the density, the higher is the free volume and the lower is the dielectric constant. Experimental results indicated that the hyperbranch polyimide-POSS composite exhibited increase solubility compare with pure polyimide.

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