

**REDUCTION OF PRODUCTION LEAD TIME FOR  
SHEET CASTING OF POLY(METHYL METHACRYLATE)**

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A Thesis Submitted in Partial Fulfilment of the Requirements  
for the Degree of Master of Science  
The Petroleum and Petrochemical College, Chulalongkorn University  
in Academic Partnership with  
The University of Michigan, The University of Oklahoma,  
and Case Western Reserve University

2003

ISBN 974-17-2323-7

£ 21094755

**Thesis Title:** Reduction of Production Lead Time for Sheet Casting of  
Poly(methyl methacrylate)  
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**Program:** Polymer Science  
**Thesis Advisors:** Asst. Prof. Pitt Supaphol  
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Accepted by the Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfilment of the requirements for the Degree of Master of Science.

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## บทคัดย่อ

จิระวุฒิ จันทเกษม: การลดเวลากระบวนการการผลิตขึ้นรูปแผ่นพอลิเมทิลเมทาคริเลต (Reduction of Production Lead Time for Sheet Casting of Poly(methyl methacrylate)) อ.ที่ปรึกษา: ผศ. ดร.พิชญ์ สุภผล และ นายโยธิน วานิชวรากิจ 76 หน้า ISBN 974-17-2323-7

พอลิเมทิลเมทาคริเลตเป็นอะคริลิกพอลิเมอร์ที่มีความสำคัญมากที่สุด โดยทั่วไป ปฏิกิริยาการสังเคราะห์มักจะอาศัยกลไกการเกิดปฏิกิริยาแบบลูกโซ่ผ่านตัวกลางแบบอนุมูลอิสระ (Free-Radical Polymerization) ซึ่งจะใช้สารเปอร์ออกไซด์หรือสารประกอบเอโซเป็นตัวริเริ่มปฏิกิริยา ในกระบวนการสังเคราะห์พอลิเมทิลเมทาคริเลตในอุตสาหกรรมมักจะใช้กระบวนการผลิตแบบบัตช์หรือแบบเบทช์ ซึ่งเป็นกระบวนการผลิตที่ง่ายที่สุดและสามารถกระทำการปรับปรุงหรือปรับเปลี่ยนกระบวนการผลิตได้ง่าย กลไกการเกิดปฏิกิริยาภายในแม่แบบของพอลิเมทิลเมทาคริเลตได้ถูกทำการศึกษาในระบบที่ใช้เป็นตัวกลางและระบบที่มีการอบในเตาอบ เพื่อทำการลดระยะเวลาการผลิตในการผลิตแผ่นพอลิเมทิลเมทาคริเลตชนิดใสที่มีความหนาเป็น 5 8 และ 10 มิลลิเมตร และแผ่นสีที่มีความหนา 3 มิลลิเมตร การพิจารณาหาระยะเวลาการผลิตที่เหมาะสมในแต่ละผลิตภัณฑ์นั้นต้องมีการพิจารณาถึงผลกระทบของความหนา ความเข้มข้นเริ่มต้นของตัวริเริ่ม และประเภทของสี ซึ่งในการศึกษาผลกระทบจากปัจจัยต่าง ๆ นั้นจะต้องมีการทำการวัดค่าความสัมพันธ์ระหว่างอุณหภูมิในแม่แบบกับเวลา อัตราการเกิดปฏิกิริยา ความแข็งที่ผิว ความทนแรงกระแทก และน้ำหนักโมเลกุลเฉลี่ย ผลจากการศึกษาพบว่าสีบางสีมีผลทำให้ระยะเวลาการผลิตเพิ่มขึ้น ซึ่งสามารถแก้ไขได้โดยเพิ่มอุณหภูมิในการทำปฏิกิริยาหรือเพิ่มปริมาณความเข้มข้นของตัวริเริ่ม แต่อย่างไรก็ตามผลจากการศึกษาพบว่าประเภทของสี ความหนาของชิ้นงาน และความเข้มข้นเริ่มต้นของตัวริเริ่ม ไม่ส่งผลกระทบต่อความแข็งที่ผิว และความทนแรงกระแทกของชิ้นงาน

## ABSTRACT

4472005063 : POLYMER SCIENCE PROGRAM

Jirawut Junkasem: Reduction of Production Lead Time for Sheet Casting of Poly(methyl methacrylate).

Thesis Advisors: Asst. Prof. Pitt Supaphol and Mr. Yothin

Wanichavarakij, 76 pp. ISBN 974-17-2323-7

Keywords : Poly(methyl methacrylate )/Casting/Simulate

Poly(methyl methacrylate) (PMMA) is one of the most important unmodified acrylic materials. PMMA is usually produced by free-radical polymerization using a peroxide or azo compound as an initiator. Typically, bulk polymerization, or cell-casting, is widely used in the industry due to its simplicity and high flexibility. The kinetics of the polymerization reaction in the cell-casting PMMA process, based primarily on water and water–air system, was studied to minimize the production time for making 5, 8, and 10–mm thick transparent PMMA sheets and 3-mm thick colored PMMA sheets. In order to optimize the production time, the effects of sheet thickness, initiator concentration (specific for each thickness), and type of colorant on the production time and mechanical properties of the as-prepared sheets were studied by observing the temperature-evolution profile, monomer conversion, surface hardness, impact strength, and molecular weight averages. It was found that the use of some types of colorant resulted in longer production times. This was solved by increasing the polymerization temperature or the initiator concentration. However, the type of colorant, sheet thickness, and initiator concentration had no effect on the mechanical properties of the as-prepared sheets.

## ACKNOWLEDGEMENTS

The author is grateful for the partial scholarship and partial funding of the thesis work provided by Postgraduate Education and Research Programs in Petroleum and Petrochemical Technology (PTT Consortium).

The author would like to give his appreciation to the PAN ASIA Industrial Co., Ltd. for full support of raw materials, equipment and very helpful knowledge.

Ministry of University Affairs supported scholarships.

Asst. Prof. Pitt Supaphol, his advisor, who gave him many supportive suggestions and a lot of motivation. He always enthusiastically came up with very practical ideas.

The MTEC who supported GPC for this thesis.

The PPC staffs and friends whom without their unselfish support.

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