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ศูนย์วิทยทรัพยากร

จุฬาลงกรณ์มหาวิทยาลัย

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ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

PRODUCTION OF HIGH PERFORMANCE BUILDING MATERIALS
FROM FLUE-GAS GYPSUM



Mr. Wichit Prakaypan

ศูนย์วิทยทรัพยากร
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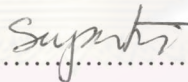


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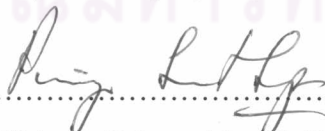
..... Thesis Advisor
(Associate Professor Supatra Jinawath, Ph.D.)



..... Member
(Sirithan Jiemsirilers, Ph. D.)



..... Member
(Veerayuth Lorprayoon, Ph.D.)



..... Member
(Prinya Sainamthip, Ph.D.)



..... Member
(Jakinee Eamsiri, Ph.D.)

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ยิปซัมฟลูแก๊ส เป็นผลพลอยได้จากกระบวนการดีซัลเฟอร์ไรเซชันแก๊สซัลเฟอร์ไดออกไซด์จากสถานี
พลังงานไฟฟ้า ได้ถูกนำมาใช้เป็นวัสดุตั้งต้นในการสังเคราะห์อัลฟา-เฮมิไฮเดรต ซึ่งเป็นวัสดุที่จะนำมาขึ้นรูป
เป็นผลิตภัณฑ์พลาสติกสำหรับงานก่อสร้างภายในอาคาร อัลฟา-เฮมิไฮเดรตถูกเตรียมโดยการเผาแคล-
ไซนียิปซัมฟลูแก๊สในอโตเคลฟที่ช่วงอุณหภูมิ 120-163°C และความดัน 2-7 bars ทำการศึกษาผลของ
เวลาที่ใช้ในการเผาแคลไซนียิปซัมฟลูแก๊สและอุณหภูมิและความดันภายในอโตเคลฟที่มีผลต่อเฟสของพลาสติกพร้อมทั้งผล
ของสารเติมแต่งชนิดต่างๆที่มีผลต่อสมบัติของพลาสติกที่เตรียมได้ จากผลการทดลองพบว่าสามารถผลิต
ขึ้นทดลองที่มีสมบัติเทียบเท่ากับที่ได้จากการใช้ยิปซัมธรรมชาติ โดยขึ้นทดลองที่เตรียมได้จะมีความ
แข็งแรงดัดสูงสุดเท่ากับ 14.36 MPa อย่างไรก็ตามการนำผลิตภัณฑ์ยิปซัมมาใช้งานจะต้องคำนึงถึงปัญหา
การดูดความชื้นจากบรรยากาศ ซึ่งจะส่งผลให้ความแข็งแรงเชิงกลของชิ้นงานลดต่ำลง ข้อดีที่สำคัญ
ผลิตภัณฑ์ยิปซัมนี้สามารถแก้ไขได้โดยการผสมยิปซัมเข้ากับอมอร์ฟัส ซิลิกา (SiO₂) อลูมินา (Al₂O₃)
และไฮดรอกไซด์ ไลม์ (Ca(OH)₂) เพื่อทำการเตรียมเป็นเฟสที่ไม่ละลายน้ำของแคลเซียม ซิลิเกต ไฮเดรต
(3CaO.2SiO₂.3H₂O) และแคลเซียม ซัลไฟโอลูมินเนตไฮเดรต (เอททริงไกท์, 3CaO.Al₂O₃.3CaSO₄.
31H₂O) จากปฏิกิริยาพอลิเมอไรเซชัน วัสดุคอมโพสิตเหล่านี้สามารถนำไปใช้ในงานก่อสร้างและมีความ
เป็นไปได้ที่จะถูกนำไปใช้ภายนอกอาคาร โดยจะทำการศึกษาถึงผลของอัตราส่วนของวัสดุที่ใส่และวิธีใน
การเร่งปฏิกิริยาเคมีต่างๆที่มีต่อสมบัติทางกายภาพและเชิงกลของวัสดุคอมโพสิต รวมทั้งผลของเวดดิ้ง/
ดรายอิ้ง ไซคลิก สตอเรจ ต่อความคงตัวของขนาดและรูปร่างของชิ้นทดลอง ซึ่งจากผลการทดลองพบว่า
ความแข็งแรงดัดสูงสุดและการเปลี่ยนแปลงเชิงเส้นหลังจากผ่านไซคลิก สตอเรจ(100 รอบ) ของวัสดุคอม-
โพสิตที่มีอายุ 90 วันเท่ากับ 154.5 MPa และ 0.0007% ตามลำดับ

ภาควิชา วัสดุศาสตร์
สาขาวิชา วัสดุศาสตร์
ปีการศึกษา 2545

ลายมือชื่อนิสิต.....*วิชิต ปรภายพรรณ*.....
ลายมือชื่ออาจารย์ที่ปรึกษา.....*supitza*.....
ลายมือชื่ออาจารย์ที่ปรึกษาร่วม.....*Heinz*.....

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KEY WORD: FLUE-GAS GYPSUM / α -HEMIHYDRATE/ ETTRINGITE / CALCIUM SILICATE
HYDRATE / FRIEDEL'S SALT

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Flue-gas gypsum, from the desulfurization of SO₂ emitting from the power plant, was used as a starting materials for the synthesis of α -hemihydrate which is used for the interior building plaster components. α -hemihydrate was prepared by calcining the flue-gas gypsum in an autoclave at temperatures of 120-163°C and pressures of 2-7 bars. The effect of calcining time upon the phase of plaster obtained and also the effects of various additives on the properties of the products were studied. It was found from the experimental results that the specimens having equivalent quality to those from natural gypsum could be obtained. The maximum flexural strength of the hydrated specimens was 14.36 MPa. However, the disadvantage of gypsum products is its ability to absorb water from ambient condition leading to the reduction in mechanical strength. This disadvantage of gypsum products could be improved by the combination of gypsum with amorphous silica (SiO₂), alumina (Al₂O₃) and hydrated lime (Ca(OH)₂) to produce the insoluble phases of calcium silicate hydrate (3CaO.2SiO₂.3H₂O) and calcium sulfoaluminate hydrate (ettringite, 3CaO.Al₂O₃.3CaSO₄.31H₂O) from pozzolanic reaction. The composite containing the mentioned phases could be used as a building component for both interior and exterior applications. The effects of raw material proportioning and accelerating methods upon the physical and mechanical properties of the composite, and also the effect of wetting/drying cyclic storage on the dimensional stability were studied. It was found from the experimental results that the maximum compressive strength and linear change after cyclic storage (100 cycles) of the 90-day composite was 154.5 MPa and 0.0007%, respectively.

Department Materials Science
Field of study Materials science.
Academic year 2002

Student's signature.....
Advisor's signature.....
Co-advisor's signature.....

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ศูนย์วิจัยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

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ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย