

**SOL-GEL PROCESSING
OF SPIROSILICATES AND THEIR POLYMERS**



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บทคัดย่อ

ศรีสุดา จูตินันท์: การเปลี่ยนแปลงจากโซลเป็นเจลของสไปโรซิลิเกต และพอลิเมอร์
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ทำการศึกษาผลของตัวเร่งปฏิกิริยา เวลาที่ใช้และคุณสมบัติของเจลที่ได้ต่อการเปลี่ยน
แปลงจากโซลเป็นเจล ของสารเตตระโคออดิเนตสไปโรซิลิเกต ในปฏิกิริยาไฮโดรไลซิส และ
ปฏิกิริยาการควบแน่น ณ สภาวะกรดและด่าง ข้อดีของกระบวนการนี้คือสามารถทำให้เกิดโครง
ร่างตาข่ายของแข็งที่มีพื้นที่ผิวจำเพาะ การเกิดพันธะไซล๊อกเซนศึกษาโดยใช้ฟูเรียร์ทรานฟอร์ม-
สเปกโตรสโคปี และการวิเคราะห์เทอร์โมกราวิเมตริก สไปโรซิลิเกตสามารถไฮโดรไลซ์ได้ทั้งใน
สภาวะกรดและด่าง โดยที่แสดงอัตราการควบแน่นต่ำสุดที่ 1% ของ กรดไฮโดรคลอริกเข้มข้น 1
โมลาร์ ซึ่งมีค่าใกล้เคียงกับจุดไอโซอิเล็กทริกของซิลิกา เจลที่เตรียมได้มีความหนาแน่นต่ำ และ
มีความเป็นอสัณฐานที่มีพื้นที่ผิว 538 ตารางเมตรต่อกรัม นอกจากตัวเร่งปฏิกิริยาแล้ว ชนิดของ
สารตั้งต้นยังมีผลต่อการเกิดเจล ในการทดลองนี้ใช้อะมิโนสไปโรซิลิเกต ซึ่งมีโครงสร้างเป็นวง
แหวนหกเหลี่ยมที่มีหมู่เมธิลีน และอะมิโนเป็นหมู่แทนที่ พันธะไซล๊อกเซนในโครงสร้างเจลจะ
เกิดขึ้นในสภาวะที่มีอุณหภูมิ และความเข้มข้นของตัวทำละลายสูง เนื่องจากความยาว และกิ่งโซ่
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ABSTRACT

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The sol-gel transition of tetra-coordinated spirosilicate via hydrolysis and condensation under acidic and basic condition is examined to study the effect of catalyst, time dependence, temperature and the properties of obtained gel. The main advantage of this process is the low temperature employed, giving the formation of solid network with a high specific surface area. FTIR spectroscopy and TGA analysis were used to characterize the formation of siloxane bonds (Si-O-Si). It is found that spirosilicate can be hydrolyzed under both acid and base catalyzed conditions, and the condensation rate to silicates is shown to be at a minimum at 1% HCl of 1M, which is the iso-electric point of silica. The prepared xerogel has a low-density and is amorphous material with surface area of 538 m²/g. Besides the catalyst media, the type of precursor also has a strong influence on the gel formation. The aminospirosilicate, six-membered ring, containing methylene and amino groups as substituents, was chosen for this study. The resulting xerogel determined by the fact that to obtain the Si-O-Si bonds, a higher concentration of solvent and higher temperature are more favorable, due to the length and branching of alkyl portion.

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TABLE OF CONTENTS

		PAGE
	Title Page	i
	Abstract (in English)	iii
	Abstract (in Thai)	iv
	Acknowledgements	v
	Table of Contents	vi
	List of Tables	x
	List of Figures	xi
CHAPTER		
I	INTRODUCTION	1
II	LITERATURE SURVEY	8
II	EXPERIMENTAL	16
	3.1 Material	16
	3.2 Equipment	17
	3.2.1 Fourier Transform Infrared Spectroscopy	17
	3.2.2 Nuclear Magnetic Resonance Spectroscopy	17
	3.2.3 Thermogravimetric Analysis	17
	3.2.4 Scanning Electron Microscope	18
	3.2.5 BET Surface Area Measurement	18
	3.2.6 Wide Angle X-Ray Diffractometer	18
	3.3 Methodology	
	3.3.1 Synthesis Method	19
	3.3.1.1 Synthesis of Tetra-Coordinated Spirosilicate, C2 from Silica and Ethylene Glycol	19

CHAPTER	PAGE
3.3.1.2 Synthesis of Aminospinosilicate, C4 from Silica and 2-Amino-2- methyl-1,3-propanediol	20
3.3.2 Determination of Curing Conditions	
3.3.2.1 Synthesis of Polymer C2	20
3.3.2.2 Synthesis of Polymer C4	21
3.3.3 Sol-gel Transition Study	22
3.3.4 Pyrolysis of Hydrolyzed Product	22
3.3.5 Density Measurement	22
IV RESULTS AND DISCUSSION	
4.1 Characterization of Synthesized Products	
4.1.1 Fourier Transform Infrared Spectroscopy	23
4.1.2 Proton and Carbon Nuclear Magnetic Resonance Spectroscopy	25
4.1.3 Thermogravimetric Analysis	25
4.2 Study of Curing Conditions	
4.2.1 Polymer C2	29
4.2.1.1 Fourier Transform Infrared Spectroscopy	30
4.2.1.2 Proton and Carbon Nuclear Magnetic Resonance Spectroscopy	31
4.2.1.3 Thermogravimetric Analysis	31
4.2.2 Polymer C4	34
4.2.2.2 Fourier Transform Infrared Spectroscopy	34

CHAPTER	PAGE
4.2.2.2 Proton and Carbon Nuclear Magnetic Resonance Spectroscopy	35
4.2.2.3 Thermogravimetric Analysis	37
4.3 Sol-gel transition study	
4.3.1 Fourier Transform Infrared Spectroscopy	
4.3.1.1 Using 1M hydrochloric acid solution	40
4.3.1.2 Using 1M ammonium hydroxide solution	44
4.3.2 Thermogravimetric Analysis	48
4.4 Characterization of pyrolyzed C2 monomer	
4.4.1 BET Surface Area Measurement	50
4.4.2 Scanning Electron Microscope	50
4.5 Density measurement	52
4.6 Sol-gel Transition Study of Poly(Glycolato-Silicate)	
4.6.1 Fourier Transform Infrared Spectroscopy	53
4.6.2 Thermogravimetric Analysis	54
4.7 Characterization of Pyrolysis Poly(Glycolato Siloxane)	
4.7.1 BET Surface Area Measurement	54
4.7.2 Wide angle X-Ray Diffractometer	55
4.8 Sol-Gel Transition Study of Aminospinosilicate C4	
4.8.1 Fourier Transform Infrared Spectroscopy	56
4.8.2 Wide angle X-Ray Diffractometer	57
4.8.3 BET Surface Area Measurement	
4.9 Sol-Gel Transition Study of C4 Polymer	58
V CONCLUSIONS AND RECOMMENDATIONS	59
REFERENCES	60

CHAPTER	PAGE
APPENDIX	63
CURRUCULUM VITEA	72

LIST OF TABLES

	PAGE
4.1 FTIR bands of C2 and C4.	23
4.2 ¹ H- and ¹³ C-NMR spectra of spirosilicate species.	25
4.3 Effect of temperature and time on the synthesis of C2 polymer.	29
4.4 The assignments of FTIR bands of polymer C2.	30
4.5 The spectrum assignments of ¹ H- and ¹³ C-NMR of spirosilicates C2.	31
4.6 Effect of temperature and time on the synthesis of C4 polymer	34
4.7 The assignments of FTIR bands of C4 polymer.	35
4.8 The spectrum assignments of ¹ H- and ¹³ C-NMR of aminospirasilicate C4.	37
4.9 The pH results of different catalyst concentration	46
4.10 The ceramic yields of the hydrolyzed monomer after using 1M HCl at various gelation time.	
4.11 The BET surface area measurement of monomer after hydrolysis with 1% of 1M HCl and NH ₄ OH at various time, followed by pyrolysis at 750°C for 7 h, as compared to fused-silica (starting material).	49
4.12 The density measurement of pyrolyzed product: C2 and fused silica (starting material).	52
4.13 The BET surface area measurement of pyrolyzed C2 polymer and fused-silica.	55

LIST OF FIGURES

FIGURE	PAGE
1.1 A monolithic glass shapes made using the sol-gel process.	4
1.2 Sketch of poly(dimethylsiloxane)PDMS chain, showing some structural information relevant to its high flexibility.	5
2.1 Raman spectra obtained at various times during the sol-gel reaction in a solution containing 1:1:0.24(vol) TMOS, MeOH, and 3×10^{-3} M aqueous HCl.	10
2.2 Schematics of silica gel network from the hydrolysis and condensation of TEOS; (A) acid and (B) base-catalyzed gel.	13
2.3 Linear shrinkage versus temperature at $1^\circ\text{C}/\text{min}$ heating rate for silica gels prepared by three different methods. a) acid hydrolysis, b) base hydrolysis, c) colloidal process.	14
2.4 Schematic of the synthesis of the tetra-coordinated spirosilicate and its derivatives.	15
3.1 Schematic of the C2 monomer synthesis.	19
3.2 Schematic of the C4 monomer synthesis.	20
3.3 Schematic of the C2 polymer synthesis.	21
3.4 Schematic of the C4 polymer synthesis.	21
4.1 FTIR spectra of tetra-coordinated spirosilicates, a) C2 and b) amino, C4.	24
4.2 ^1H -and ^{13}C -NMR spectra of tetra-coordinated spirosilicate.	26
4.3 ^1H -and ^{13}C -NMR spectra of aminospirosilicate.	27
4.4 TGA thermograms showing (%) weight loss due to thermal changes of tetra-coordinated a) spirosilicate, C2 and b) aminospirosilicate, C4.	28
4.5 FTIR spectrum of C2 polymer. (a)	30

FIGURE	PAGE
4.6 ^1H -and ^{13}C -NMR spectra of C2 polymer.	32
4.7 (a) TGA thermograms showing (%) weight loss due to thermal changes.	33
4.7 (b) TGA thermograms showing decomposition temperatures of C2 monomer and polymers.	33
4.8 FTIR spectrum of polymer C4.	35
4.9 ^1H -and ^{13}C -NMR spectra of C4 polymer.	36
4.10 TGA thermogram showing (%) weight loss due to thermal changes.	37
4.11 Schematic of hydrolysis and condensation under hydrochloric acid solution.	38
4.12 The schematic of hydrolysis and condensation under ammonium hydroxide solution.	39
4.13 FTIR spectra of hydrolyzed C2 monomer product with (a) 1% and (b) 2% of 1M HCl at room temperature.	40
4.14 FTIR spectrum of fused silica.	42
4.15 The time-dependence of hydrolyzed products of C2 monomer with 1%-5% of 1M HCl at room temperature.	43
4.16 FTIR spectra showing the effect of temperature to the hydrolyzed product.	44
4.17 The time-dependence of hydrolyzed products of monomer C2 with 1%-4% of 1M NH_4OH at room temperature.	45
4.18 TGA thermograms showing percent ceramic yield at various times after hydrolysis with 1M HCl at (a) 1% and (b) 2%.	48
4.19 SEM of hydrolyzed (a and b) spirosilicate C2 and pyrolyzed (c and d).	50

FIGURE	PAGE
4.20 FTIR spectra showing the effect of temperature on the hydrolyzed polymer product.	53
4.21 TGA thermograms showing percent ceramic yields of hydrolyzed polymer at 40° and 60°C.	54
4.22 XRD patterns of pyrolyzed monomer, pyrolyzed polymer and fused- silica.	55
4.23 FTIR spectra showing the effect time on the hydrolyzed C4 product at 60°C.	56
4.24 TGA thermogram showing percent ceramic yield of hydrolyzed aminospirosilicate, C4 at 60°C for 1, 3 and 4 h.	57
4.25 The proposed mechanism occurring during hydrolysis of amino spirosilicate C4 with HCl solution.	58