

**SYNTHESIS OF SPIROSILICATES DIRECTLY FROM SILICA AND  
ETHYLENE GLYCOL/ETHYLENE GLYCOL DERIVATIVES**

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A Thesis Submitted in Partial Fulfillment 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

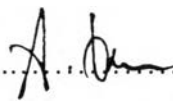
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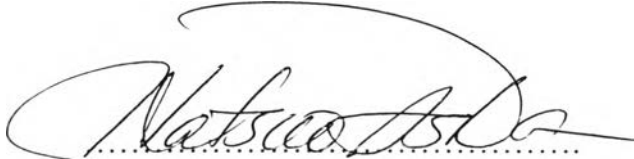
**Thesis Title** : Synthesis of Spirosilicates Directly from Silica and Ethylene Glycol/Ethylene Glycol Derivatives  
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**Program** : Polymer Science  
**Thesis Advisors** : 1. Professor Hatsuo Ishida  
2. Assoc. Prof. Sujitra Wongkasemjit

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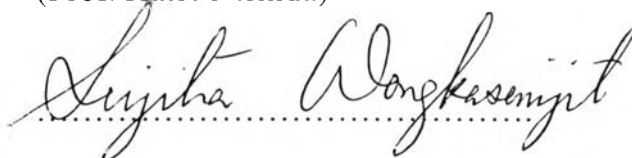
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## ABSTRACT

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KEY WORDS : Tetracoordinated Spirosilicate/ Spirosilicate/  
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Sun Chivin: Synthesis of Spirosilicates Directly  
from Silica and Ethylene Glycol/Ethylene Glycol  
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Tetracoordinated spirosilicates can be synthesized directly from the reaction of very inexpensive and plentiful material silica {SiO<sub>2</sub>} and ethylene glycol {EG} in the presence of triethylenetetramine {TETA}, as catalyst with and without potassium hydroxide {KOH} as co-catalyst. The reactions were run under nitrogen gas with constant magnetically stirring at 200°C. The reactions were completed at the reaction time of 10-18 hours depending on the catalysts. The reaction using only TETA was completed in 18 hours. With potassium hydroxide the reactions occurred much faster. When 3-amino-1,2-propanediol, or 2-amino-2-methyl-1,3-propanediol, was employed, the reaction had to be run under vacuum at 0.1mmHg, 160°C, and was completed in 14 and 24 hours, respectively. The structures of spirosilicates were fully characterized using FT-IR, (<sup>1</sup>H-, <sup>13</sup>C-, <sup>29</sup>Si-)NMR, FAB<sup>+</sup>-MS, TGA, and DSC.

ต้นฉบับ หน้าขาดหาย

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