

GEOPOLYMER Camp 2014

**Engineering properties and microstructure of
high calcium based geopolymer from Mae-moh
power plant**

Cbit-KU

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Background

Introduction

Lampang Province -Mae Moh



3,500,000 tons/year



Background

Introduction

Geopolymerization

WASTE



Geopolymer

Construction materials



Sustainable Development

Objectives

Introduction

1

Properties of geopolymer paste

- Setting time
- Compressive strength
- Density

2

Microstructure of geopolymer paste

- SEM / EDS
- TEM

3

Properties of geopolymer mortar products

- Roof tile

Materials & Method

	Mix proportion (1000 g)		
ID	FA	NaOH	Na ₂ SiO ₃
FA-60	600	200	200
FA-65	650	175	175
FA-70	700	150	150

Fly ash

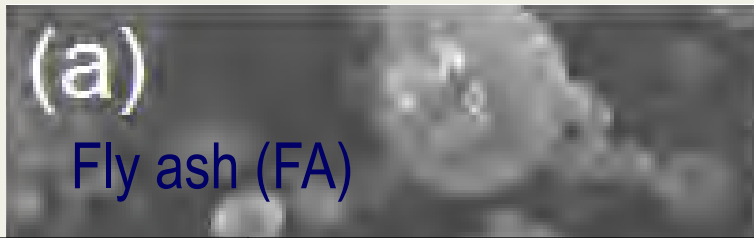
(Class C)

NaOH

(8 M)

Sodium Silicate

(SiO₂:Na₂O = 3:1)



Chemical composition (mass %)

Raw material	SiO ₂	Al ₂ O ₃	CaO	Fe ₂ O ₃	MgO	Na ₂ O	K ₂ O	Loss on ignition
FA	35.3	21.5	18.7	14.2	3.0	2.5	2.0	0.4

Setting time



FA-60

75-80 min



FA-65

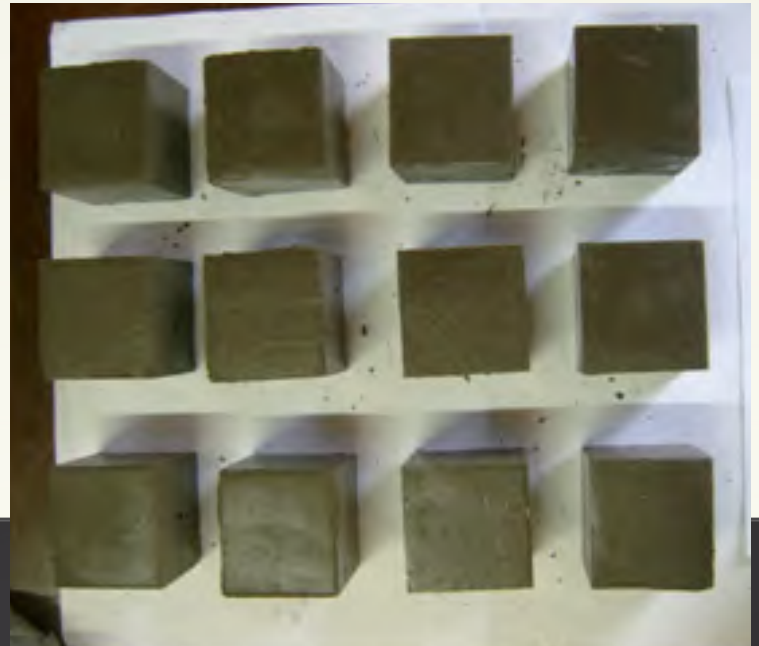
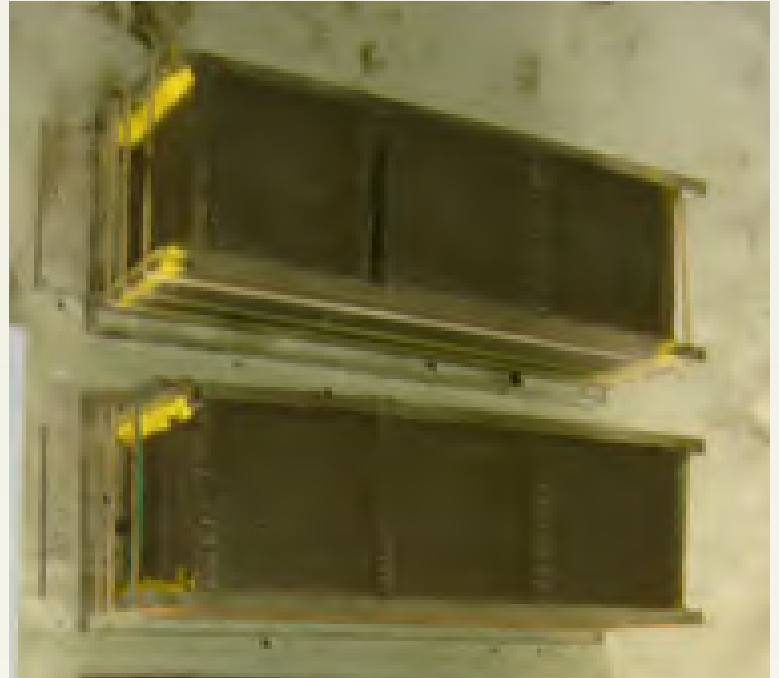
60-65 min



FA-70

45-50 min







Compressive Strength (7 d)



FA-60

5.0-7.3 MPa



FA-65

15.3-16.4 MPa



FA-70

20.5-21.7 MPa





Compressive Strength (28 d)



FA-60

15.1-17.2 MPa



FA-65

23.4-24.3 MPa



FA-70

25.1-27.6 MPa



Density (28 d)



FA-60

1720 kg/m³



FA-65

1750 kg/m³



FA-70

1790 kg/m³

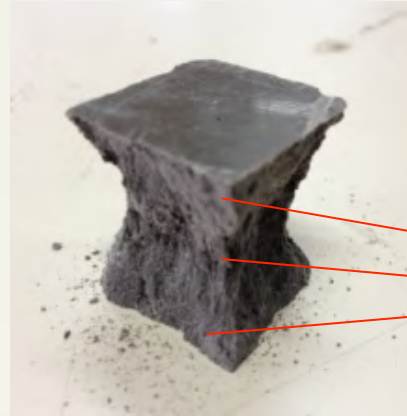


SEM

FA-60

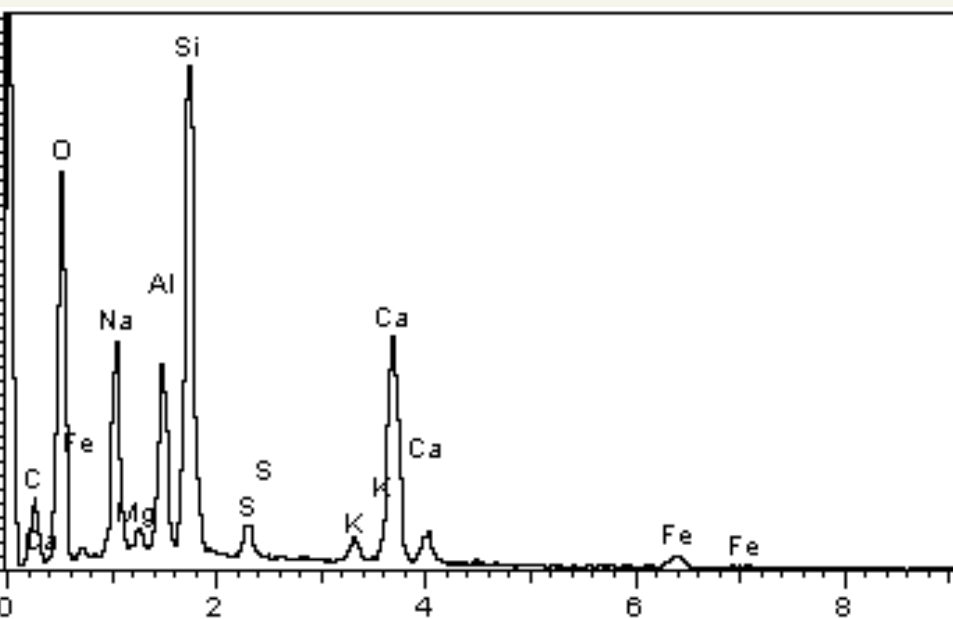
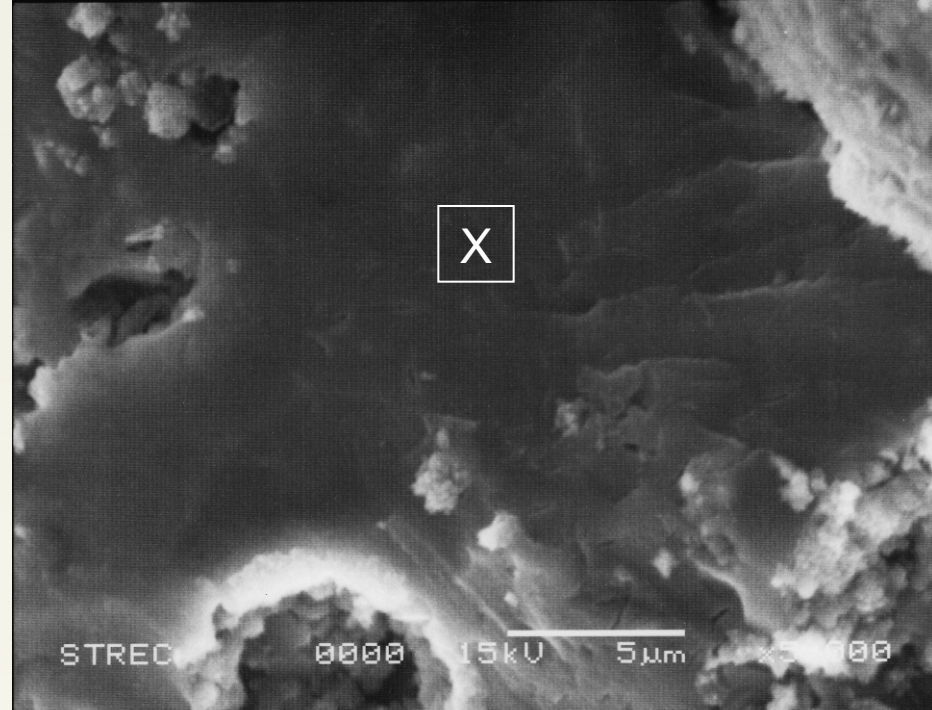
FA-65

FA-70



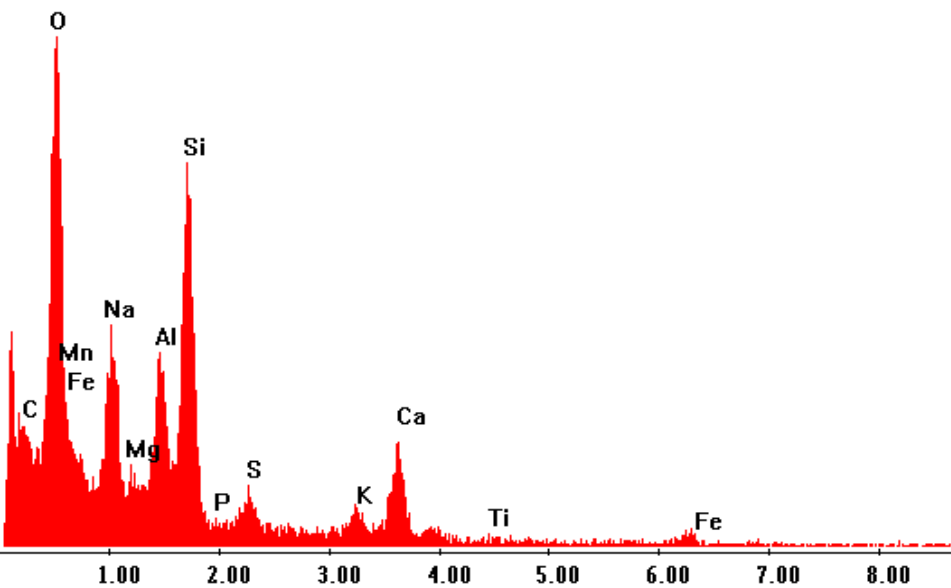
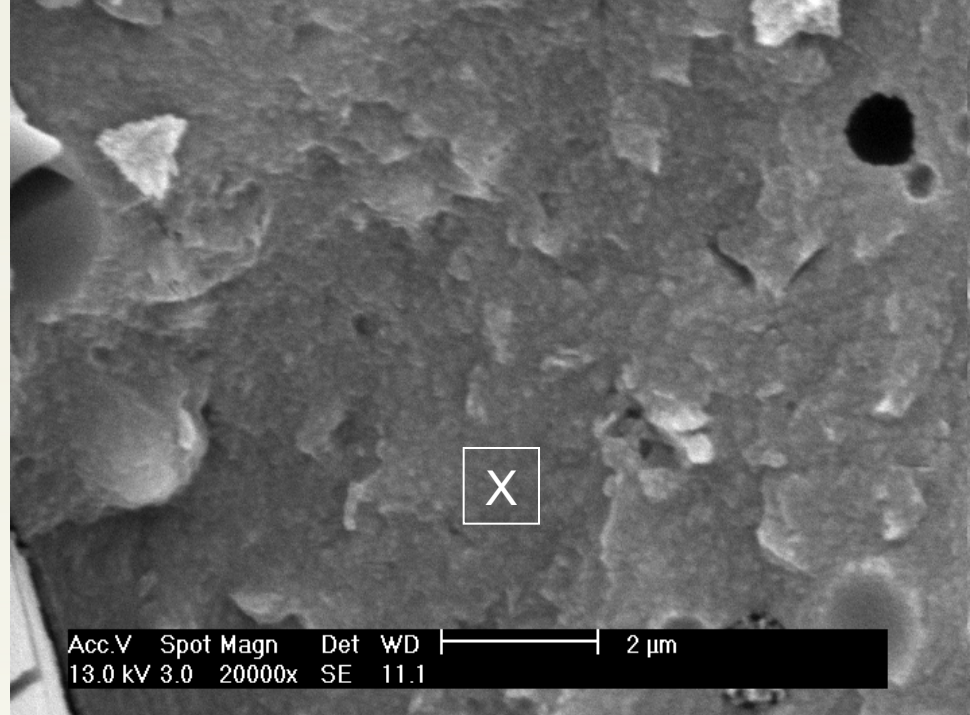
FA-60

Si/Al = 2.89-3.19



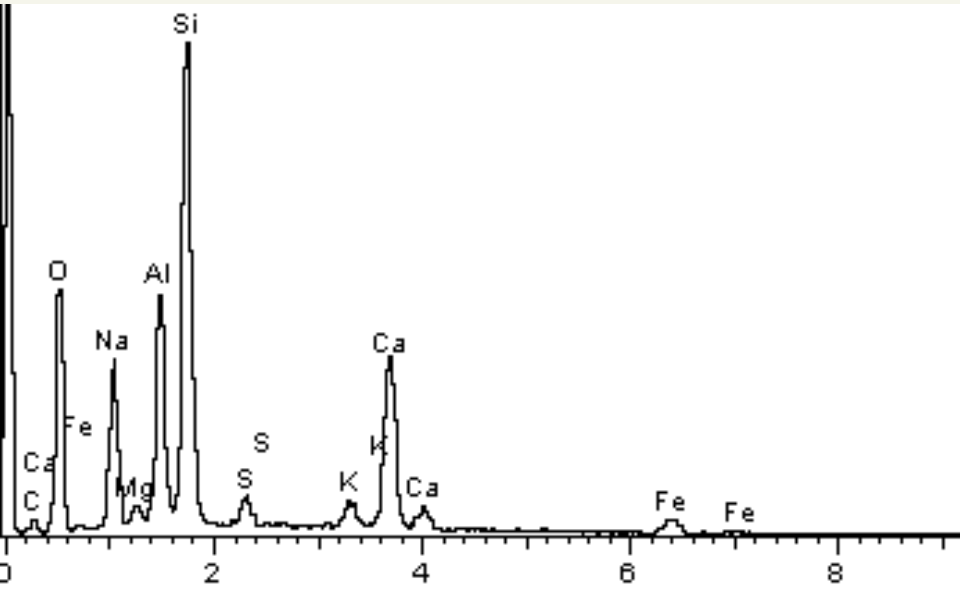
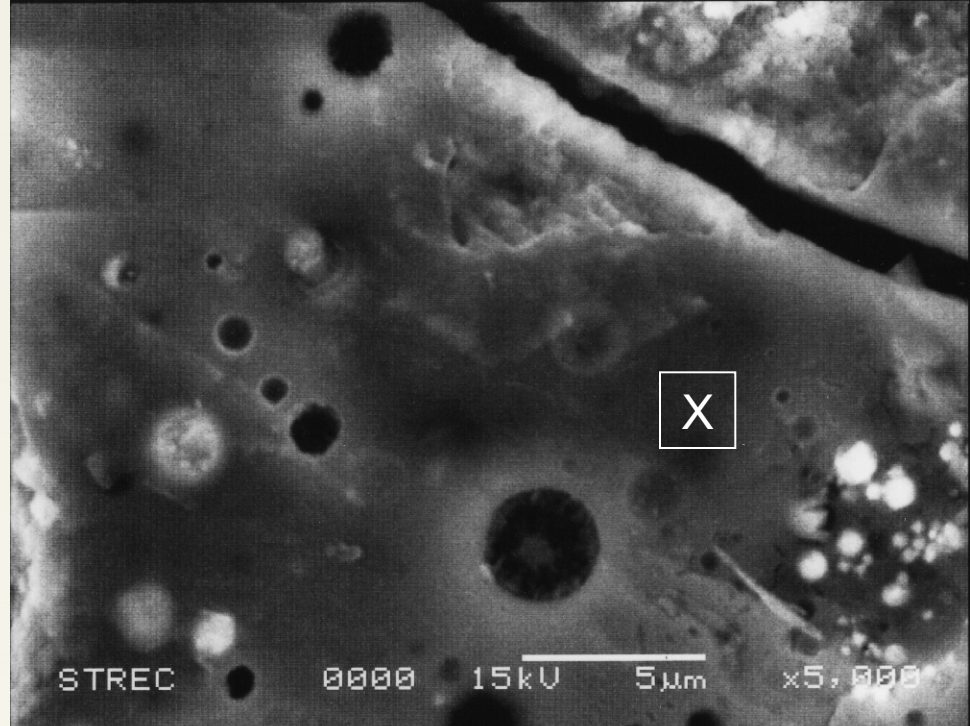
FA-65

Si/Al = 2.56-2.70



FA-70

Si/Al = 2.26-2.44



SEM

FA 60%

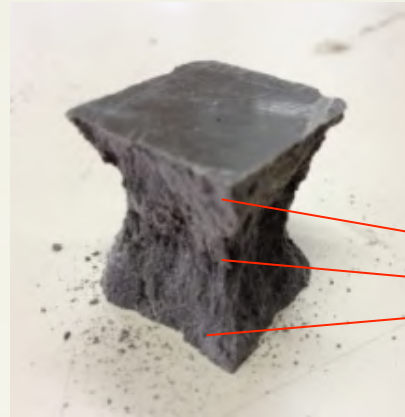
Si/Al = 2.89-3.19

FA 65%

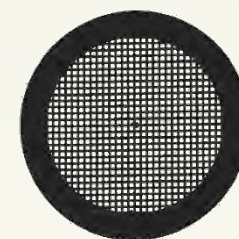
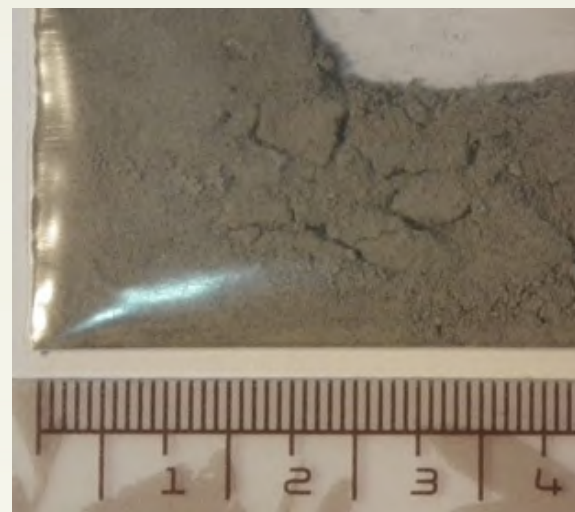
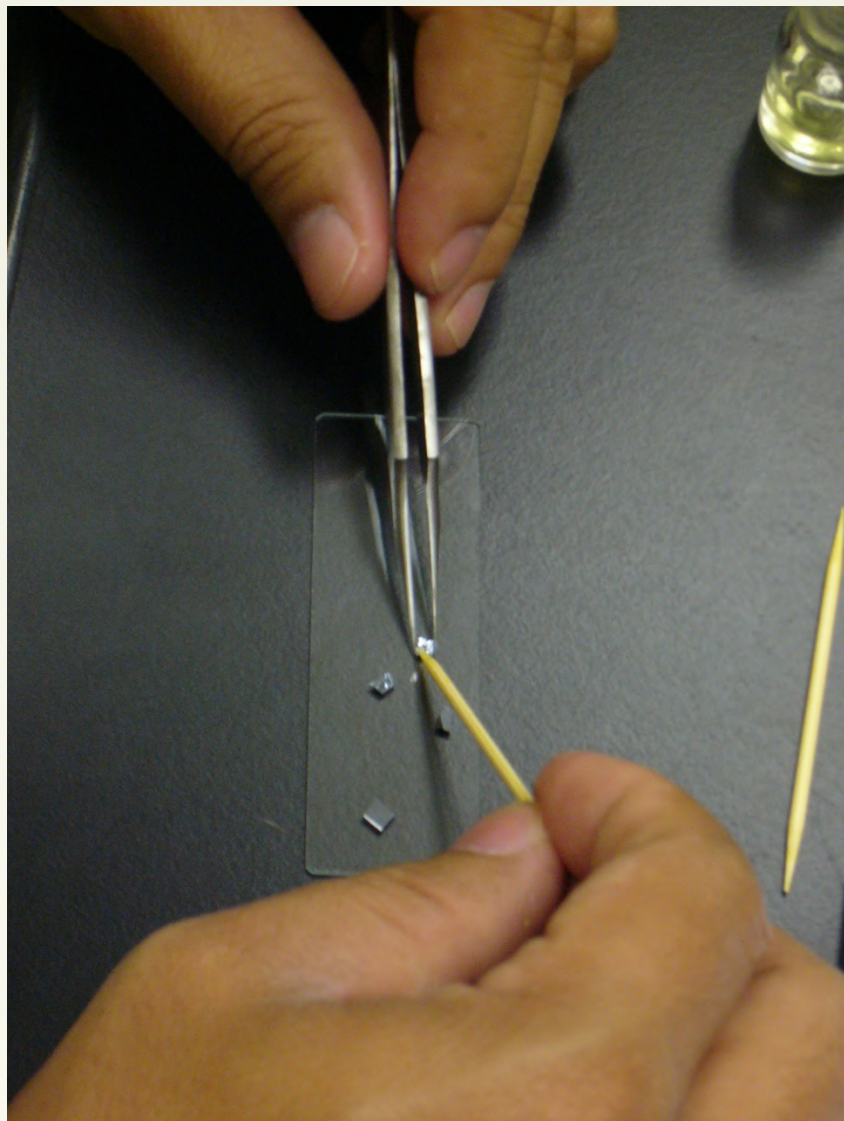
Si/Al = 2.56-2.70

FA 70 %

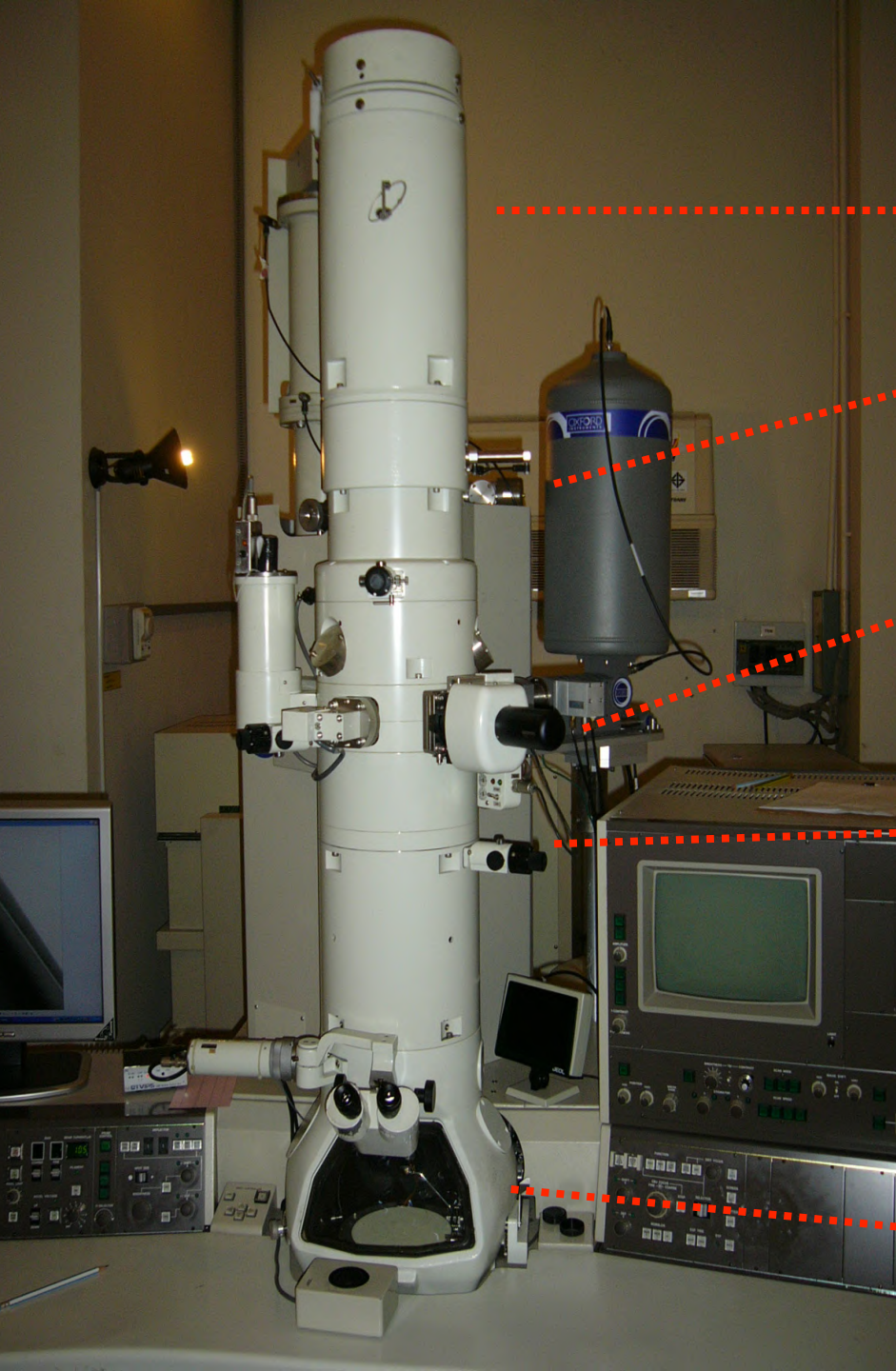
Si/Al = 2.26-2.44



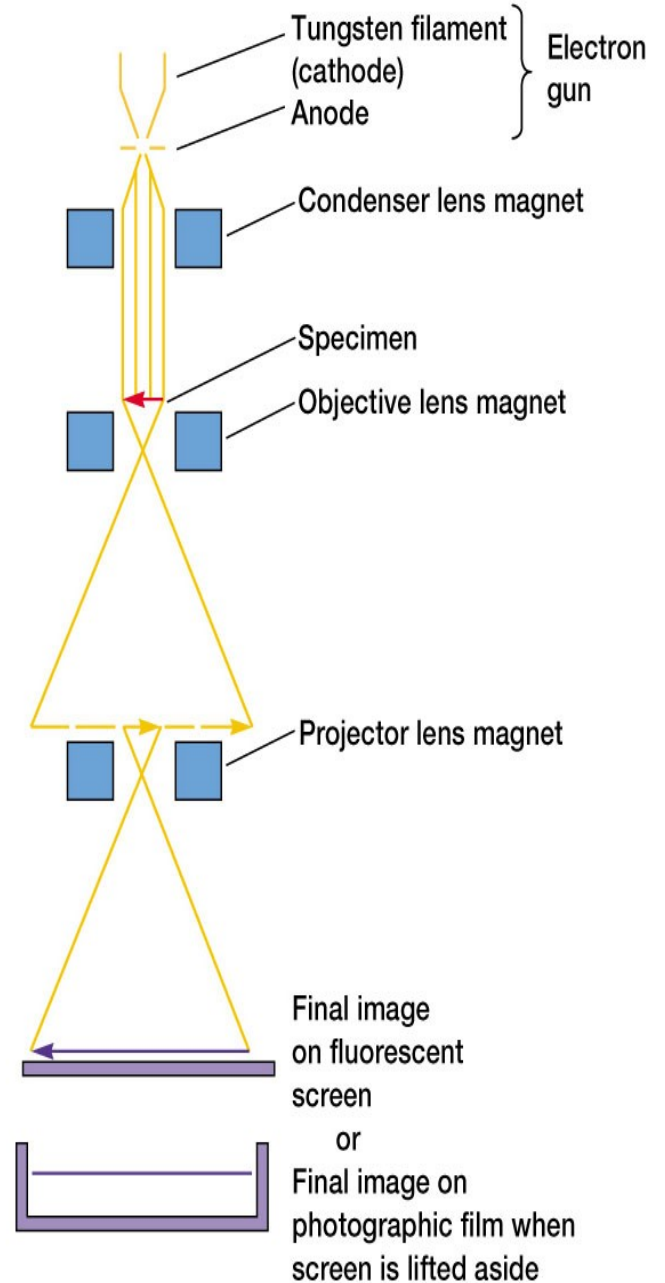
TEM



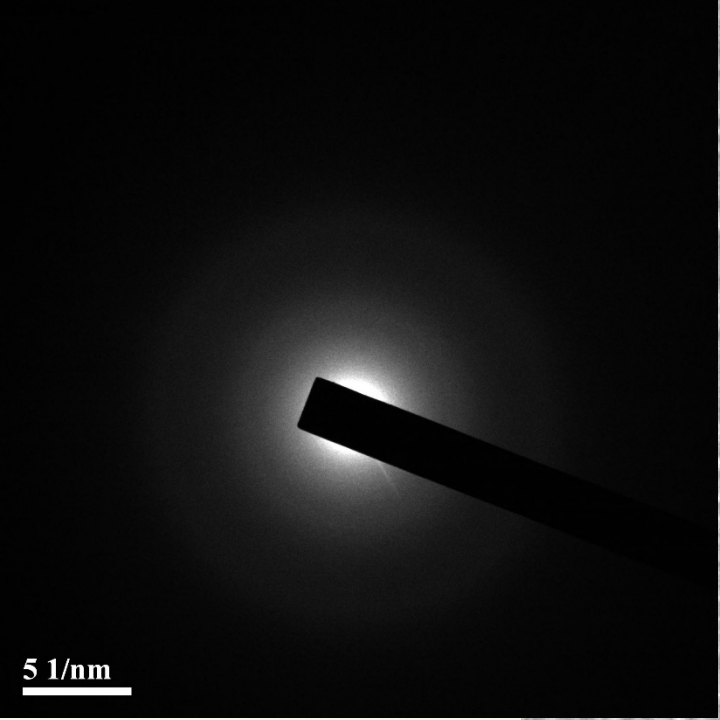
FA-65



Transmission electron microscope







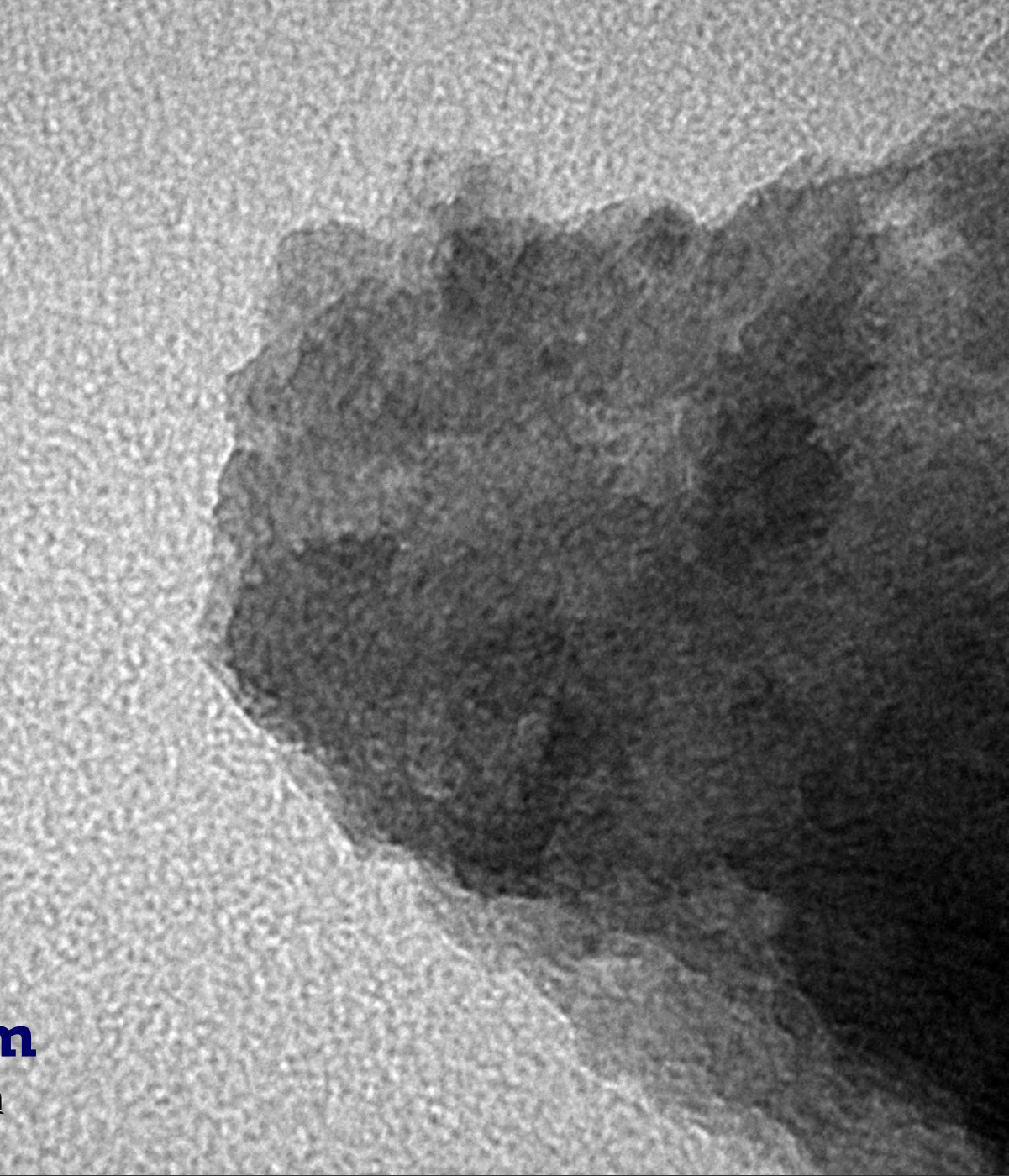
FA 65%

Si/Al = 2.63-2.83

20 nm

20 nm

A 20 nm scale bar is shown at the bottom left of the TEM image.

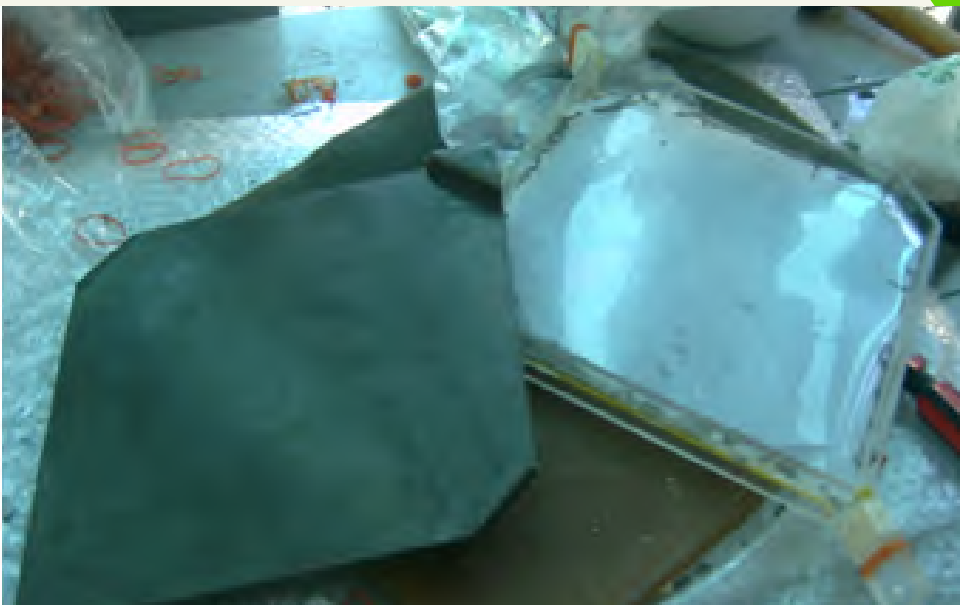




**Geopolymer
paste FA-65**

(1 Kg)

+ Sand (1.5 Kg)





KRA-BUANG --- WOW



Tile/Roof tile



Kite



Properties

Max point load

= 302 N. (7d)

= 677 N. (28d)

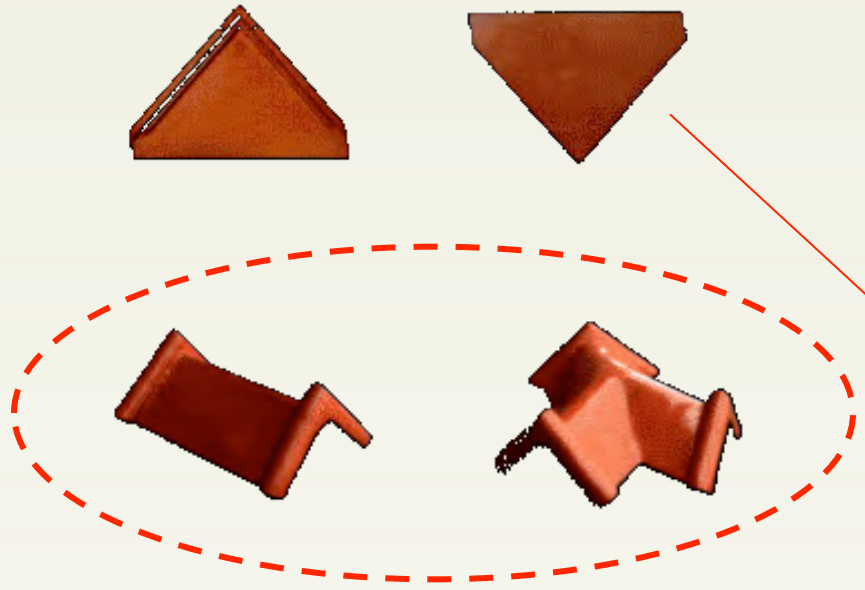
Density

= 1900-1990 Kg/m³



Water leakage test



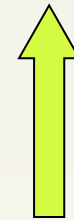


Conclusions

Strength & Density



Setting time



**FA / Solution
weight ratio**

Conclusions

Alkali solution

+

**High calcium FA from
Mae Moh Plant**



**Geopolymer
roof tile**

THANK YOU

(THAI)

Khob-kun-Krub – for male

Khob-kun-Ka – for female

