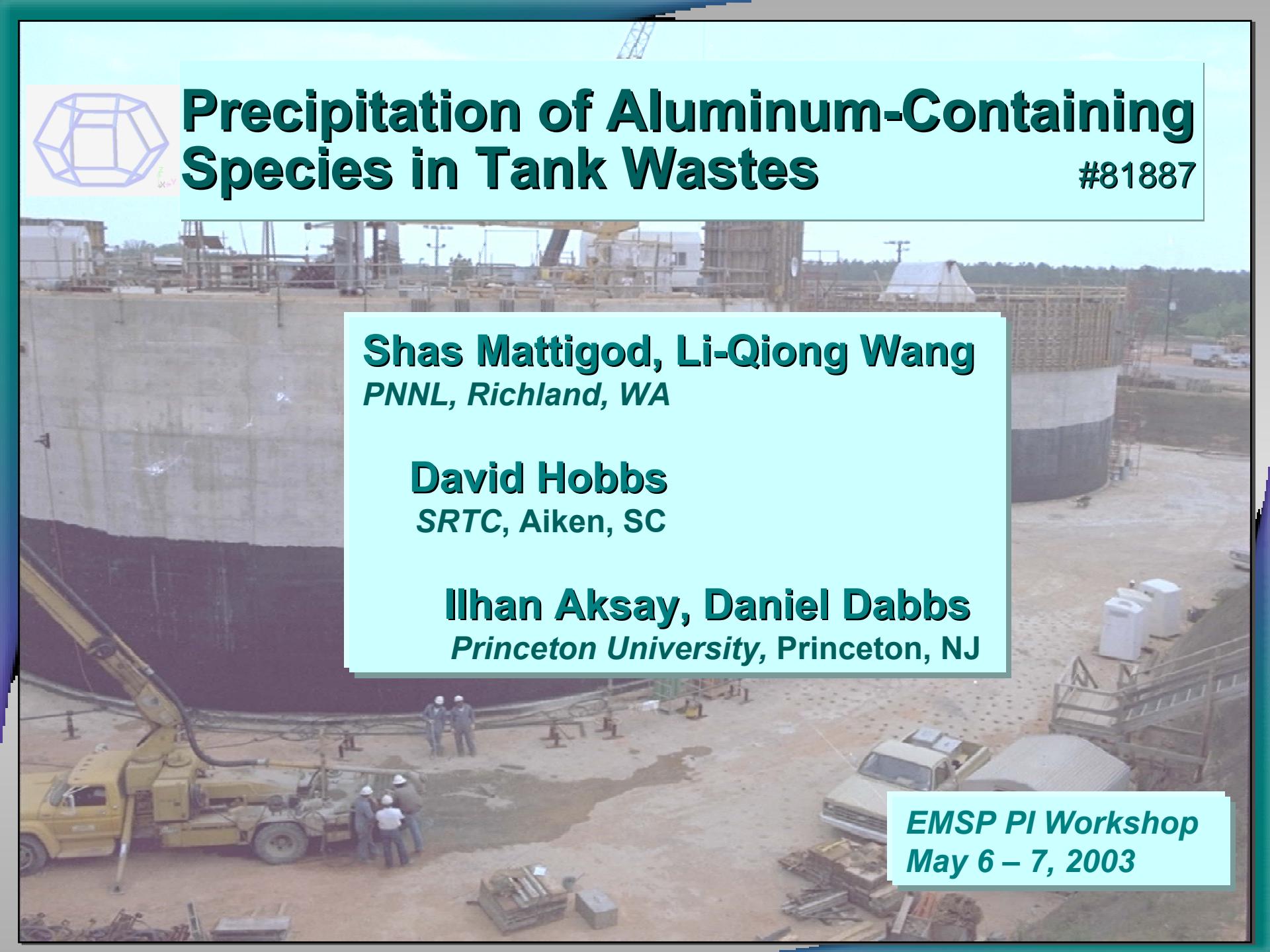




Precipitation of Aluminum-Containing Species in Tank Wastes

#81887



Shas Mattigod, Li-Qiong Wang
PNNL, Richland, WA

David Hobbs
SRTC, Aiken, SC

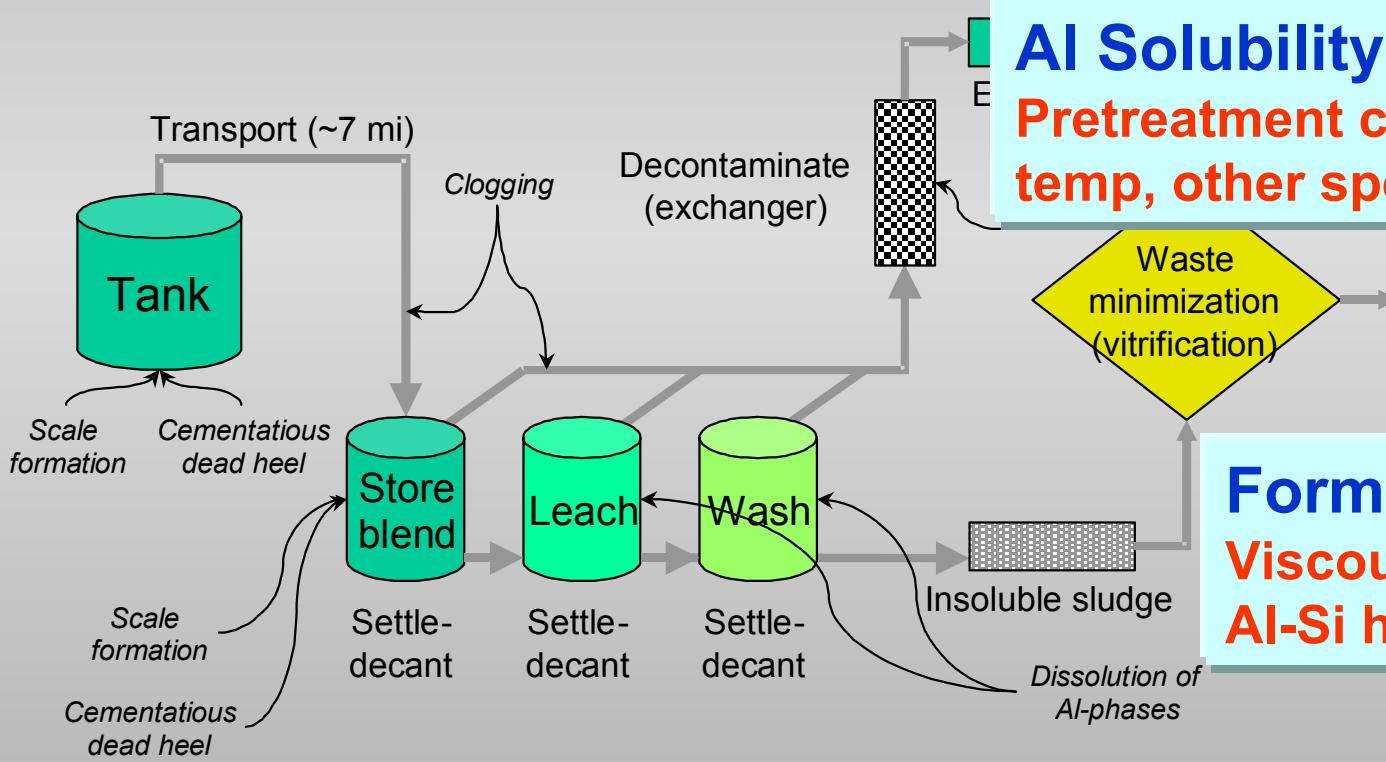
Ilhan Aksay, Daniel Dabbs
Princeton University, Princeton, NJ

EMSP PI Workshop
May 6 – 7, 2003

Relevance

Pretreatment Steps

Wash, leach, sediment,
decant, evaporate, ion exch



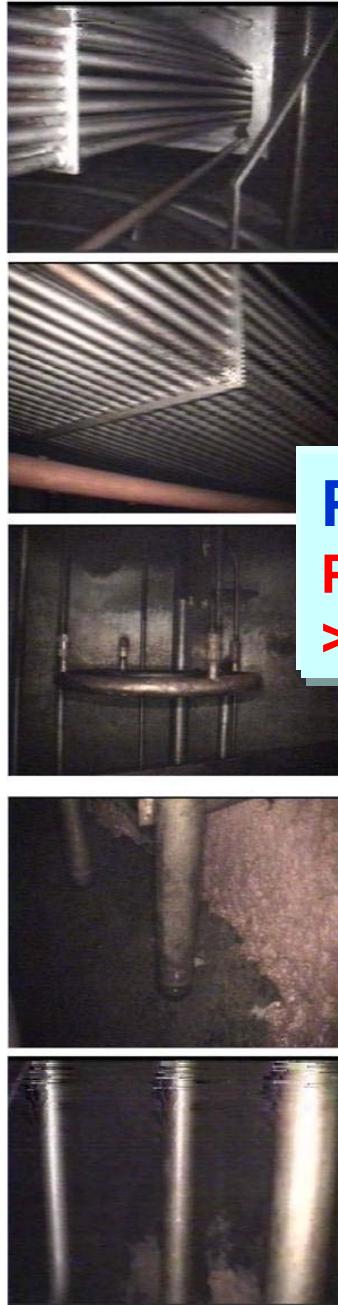
AI Solubility affected by
Pretreatment conditions - pH,
temp, other species

Formation of
Viscous gels
AI-Si hard scales

4/30/01



6/07/01



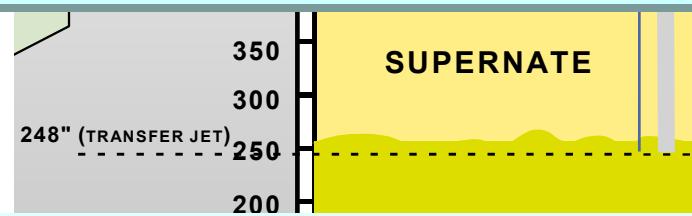
SRS 2H-Evaporator

SEPARATOR
POT

GRAVITY

Precipitates

Plugged concentrate line (97 - 98)
>3000 kg solids in evaporator (99)



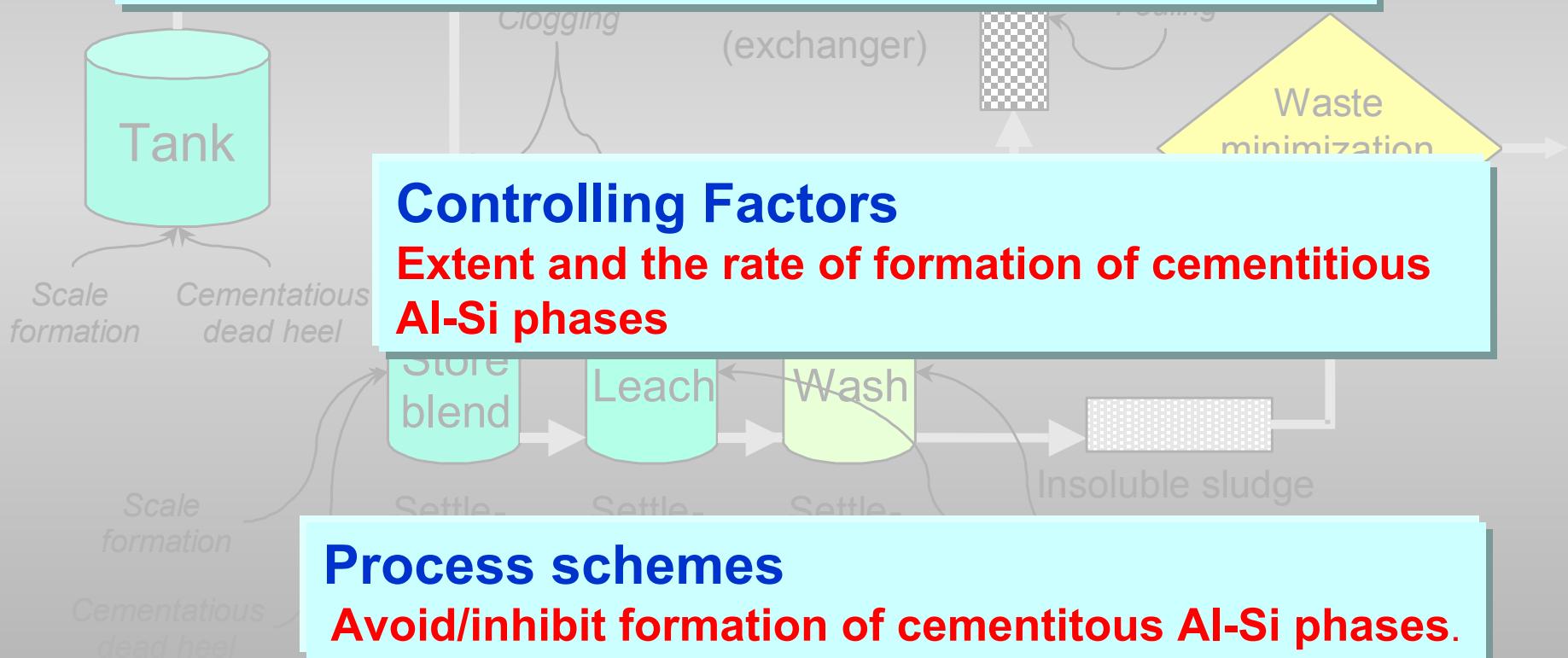
Down time and Cost

GDL: 4 mo - \$4M

Evaporator: >22 mo, \$10+ M

Critical Need

Mechanisms of formation and transformation –
Al-Si phases under process conditions
 $\text{Si}/\text{Al} \sim 0.003$, high salt, OH, temperature



Research Plan

Identify and Characterize insoluble Al-Si phases

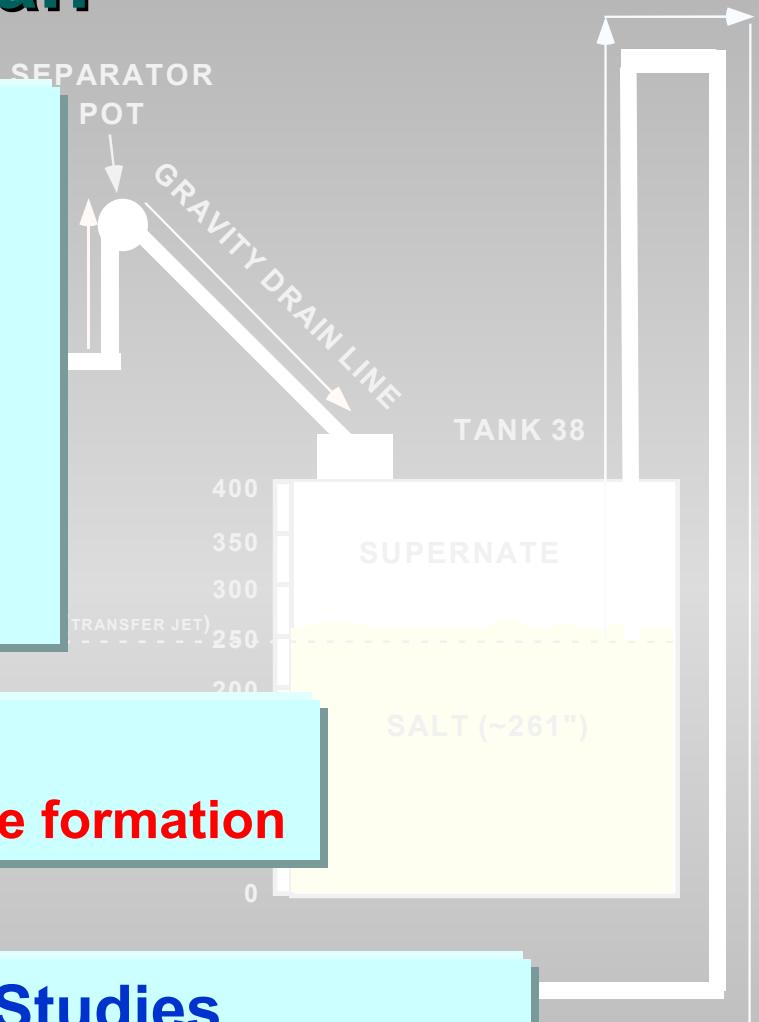
Si 0.01 M

Al 0.2 – 0.5 M

NaOH 0.1 – 4.5 M

NaNO₃ 5.0 M

Temp. 40, 80, 120, 175 °C



Role of Organics

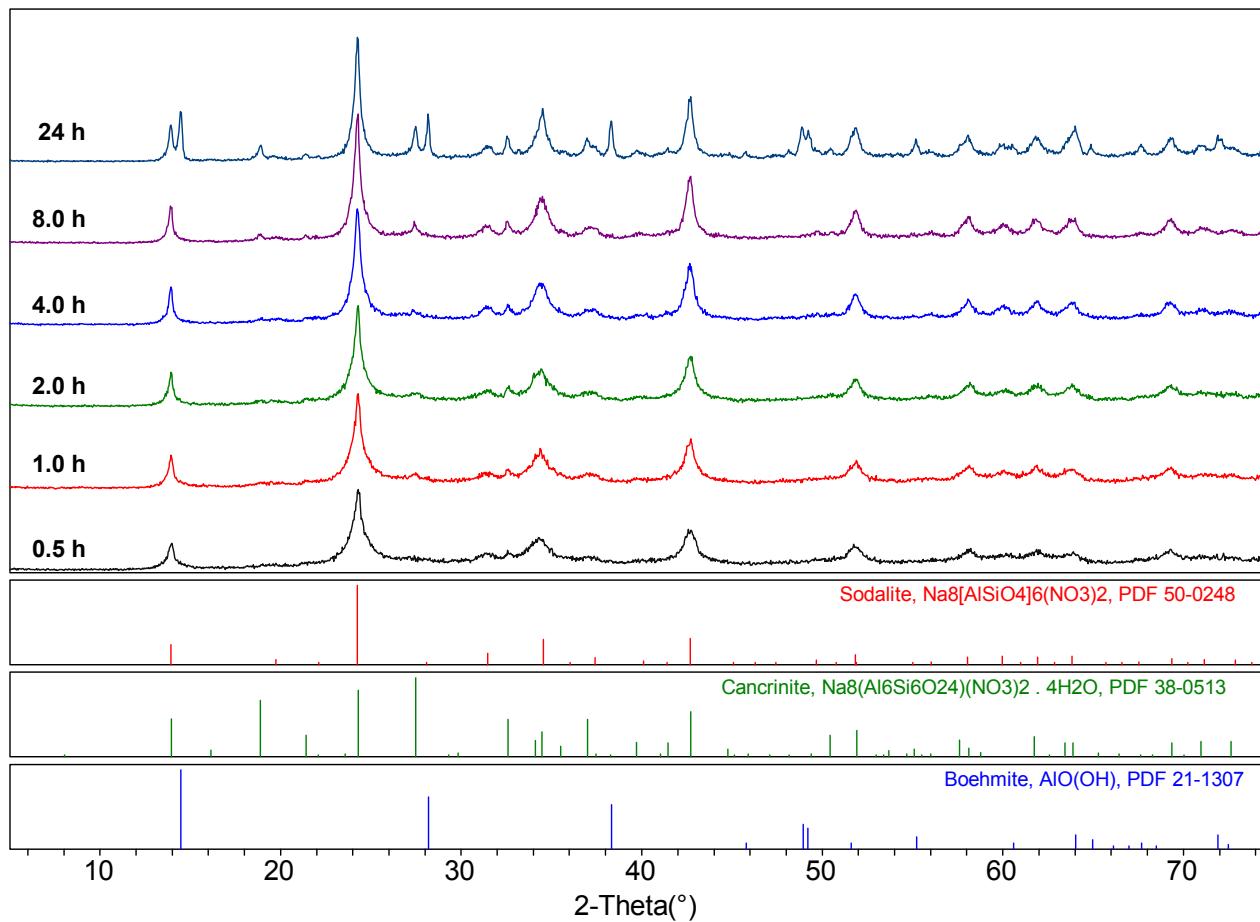
Inhibit precipitation and scale formation

Phase Equilibrium Studies

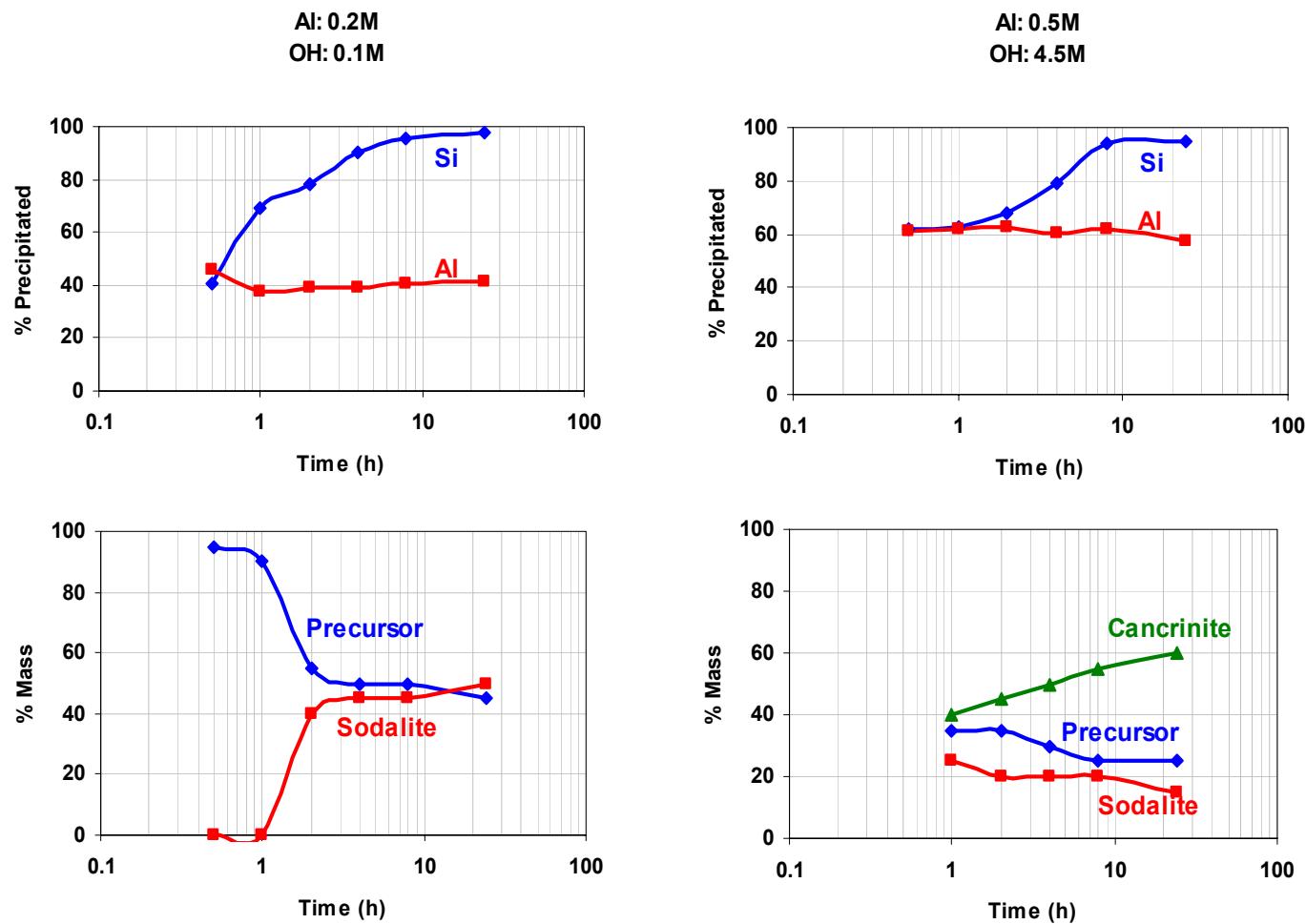
Verify Stability regions in activity diagrams

Reaction Progress 175 °C

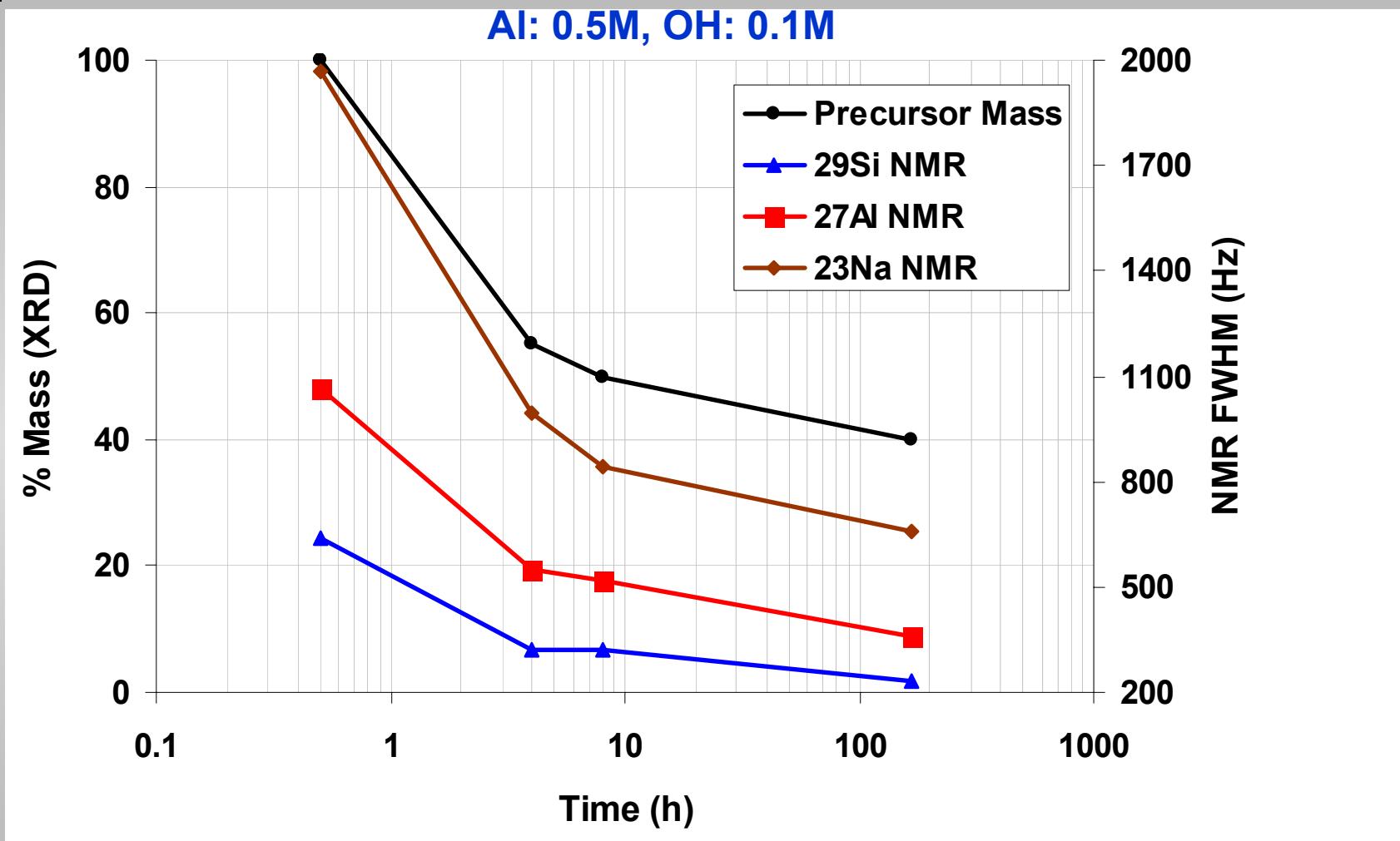
Al: 0.2M, OH: 0.1M



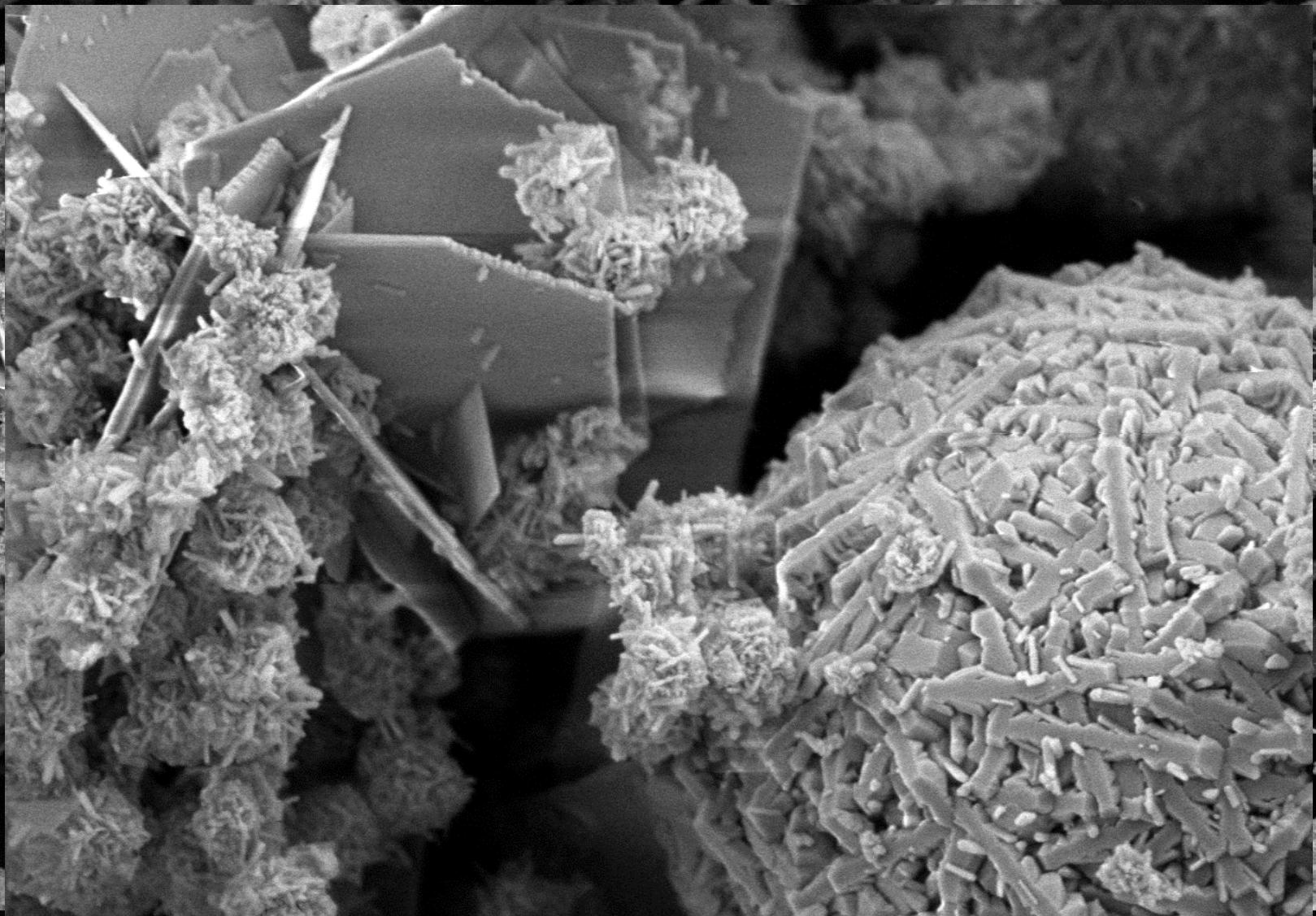
Solid Phase Formation from Tank Waste Simulants – 120 °C



NMR Data 80 °C



Solid Phase Morphology - 175 °C, 24 h



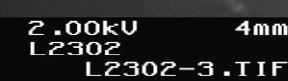
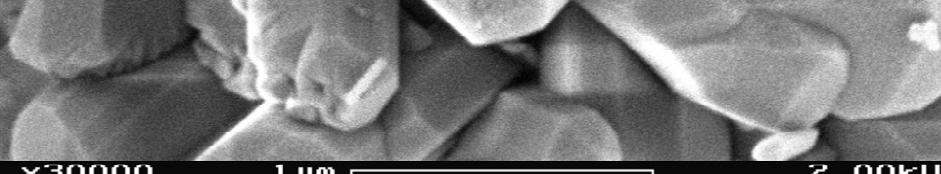
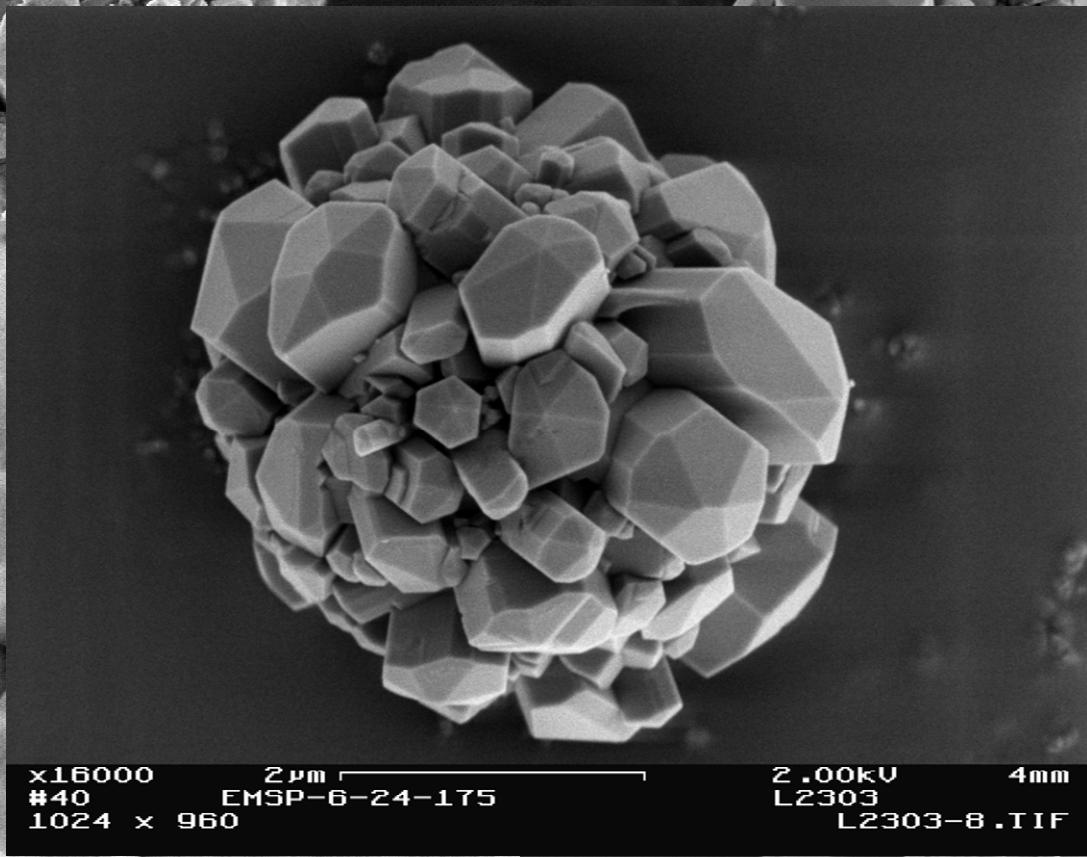
x3000
#31
1024

x15000
#31
1024 > 1024 x 960

2 μm
EMSP-2-24-175

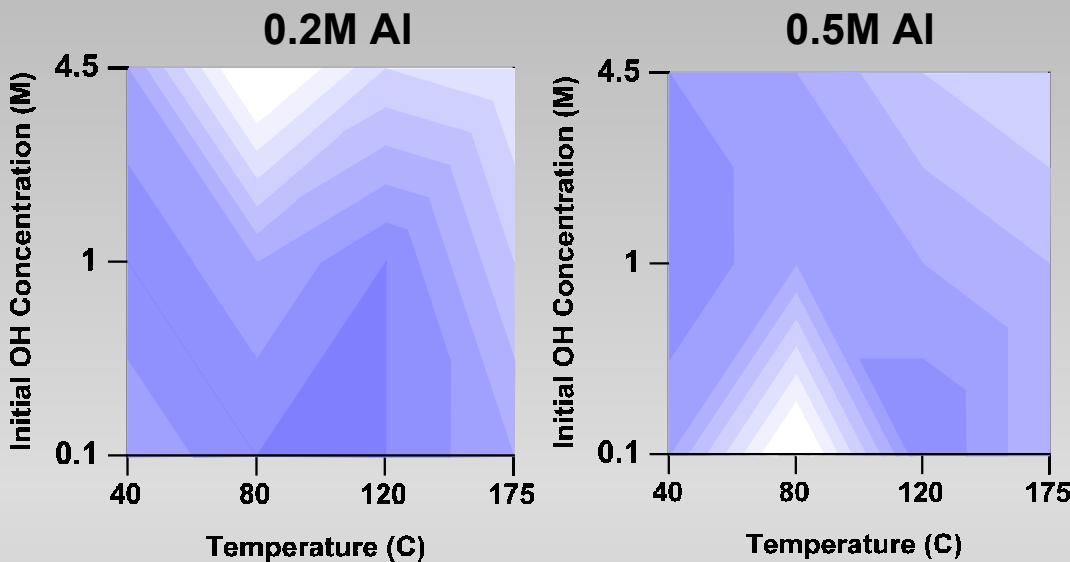
2.00kV
L2299
L2299-6.TIF
4mm

Cancrinite Morphology - 175 °C, 24 h

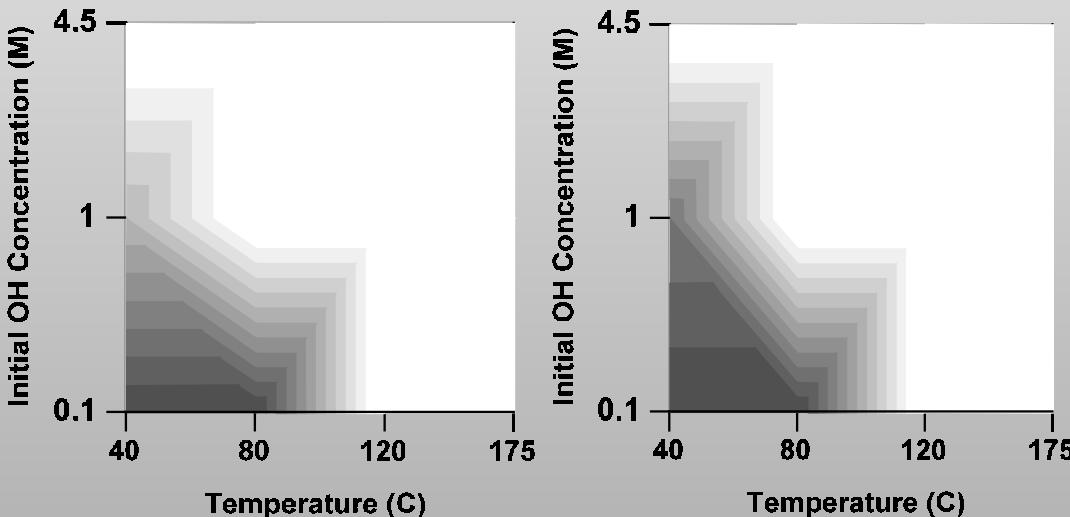


Predominance Diagram

Precursor
Phase

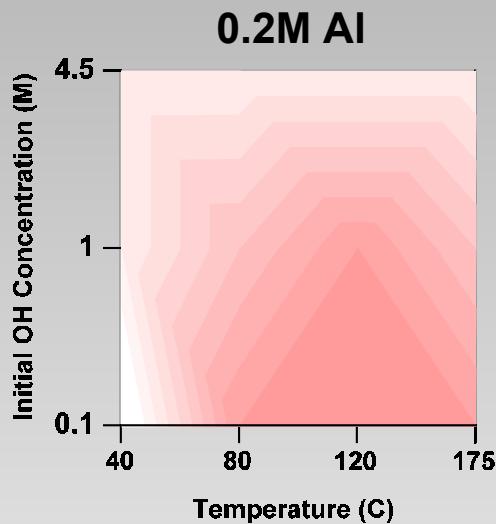


Zeolite A

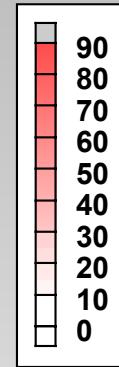
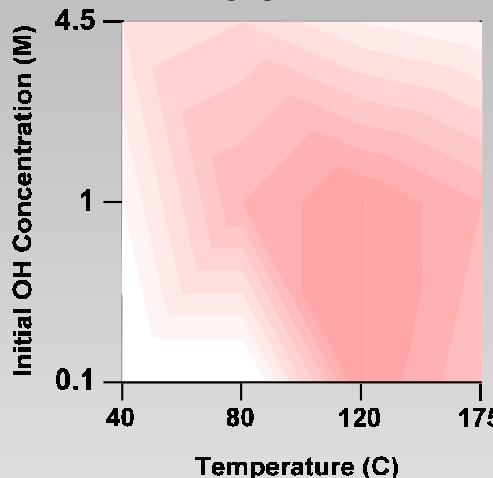


Predominance Diagram

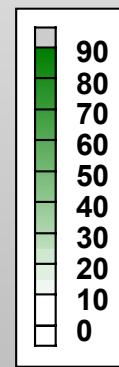
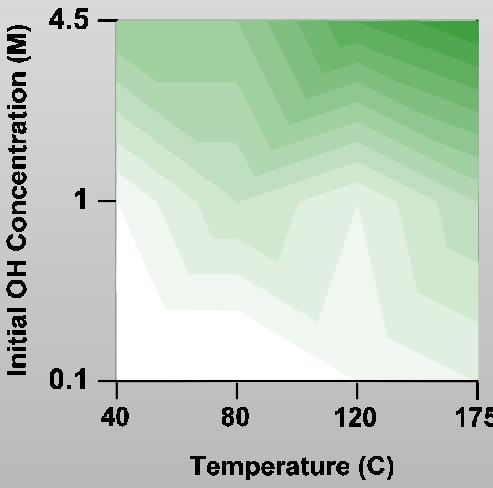
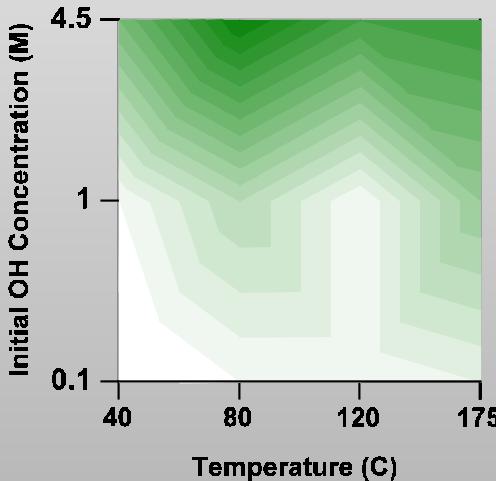
Sodalite



0.5 M Al



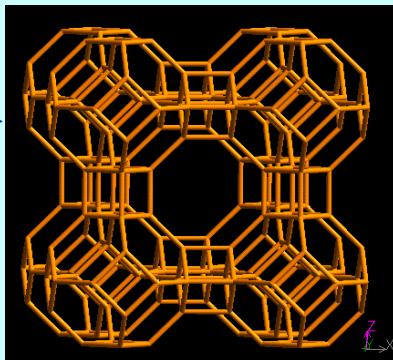
Cancrinite



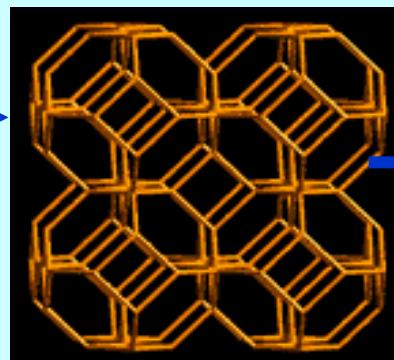
Synopsis

Solid Phase Formation

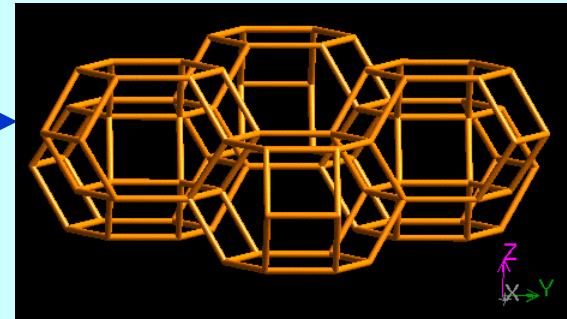
precursor



zeolite A



sodalite



cancrinite

Dominant Phases

Low caustic – lower temp: **Zeolite A**

Low caustic – high Al: **Gibbsite, boehmite**

Low caustic – moderate temp: **Sodalite**

High caustic - higher temp: **Cancrinite**

