Fluid-bed Gasification

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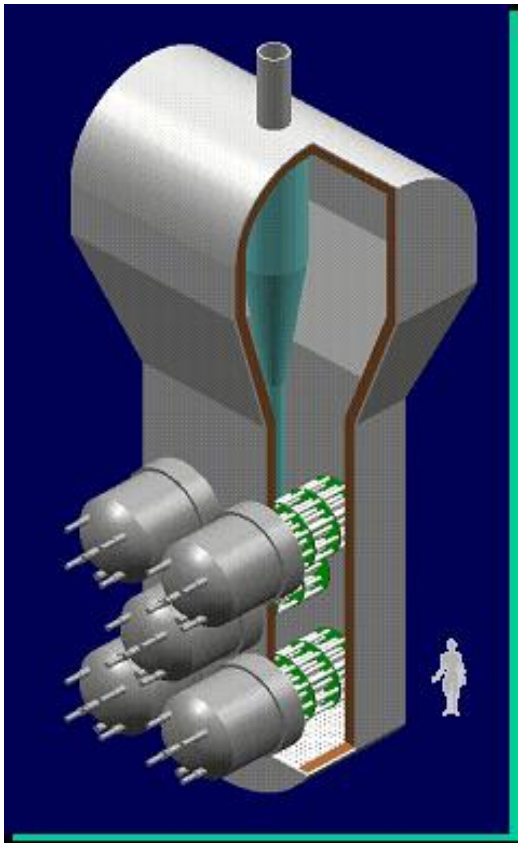
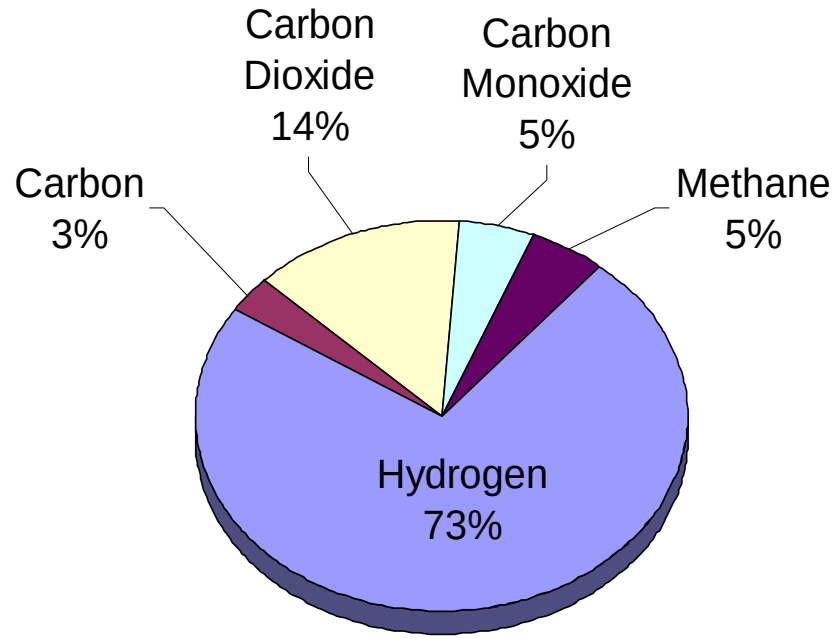
Industrial Motivation

MTCI Fluidized Reformer



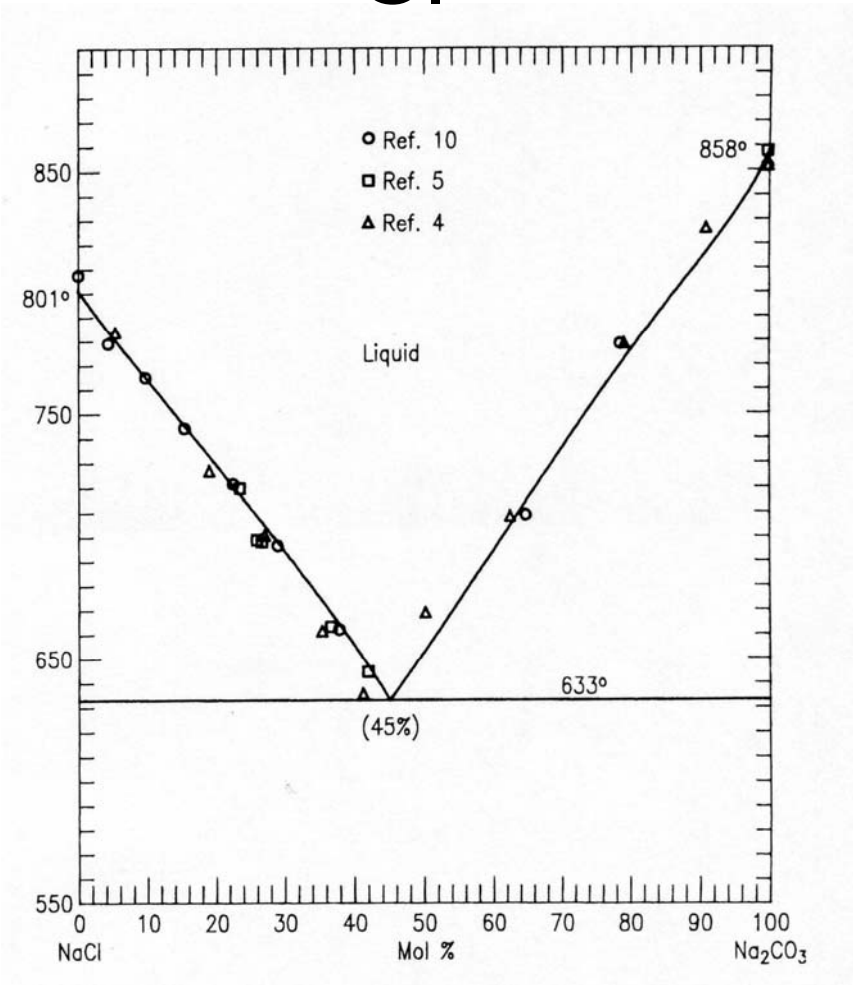
Steam fluidized at 580-620ºC. Superficial Gas velocity ~ 1.4 ft/sec



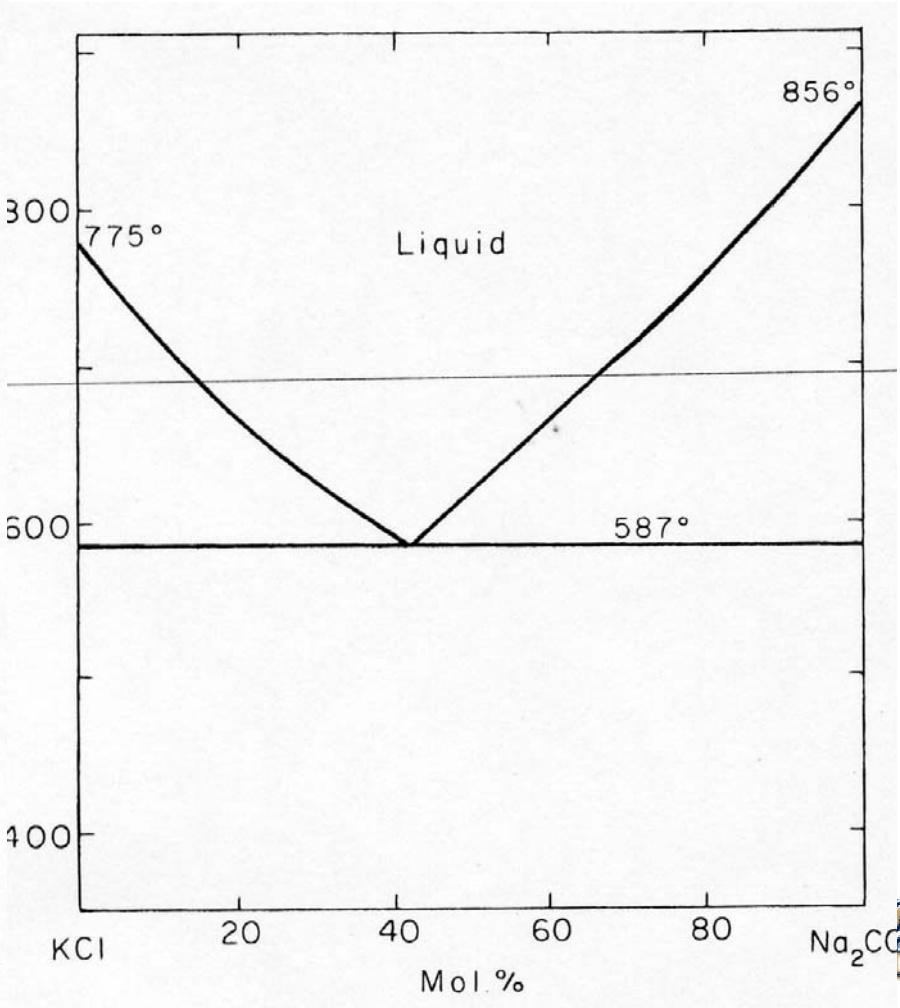
Product gas from LTBLG is a high-quality, medium-BTU fuel at 350 BTU/scf (dry basis) and provides all the necessary fuel for the pulsed combustors.

NPE Strongly Influence Sintering

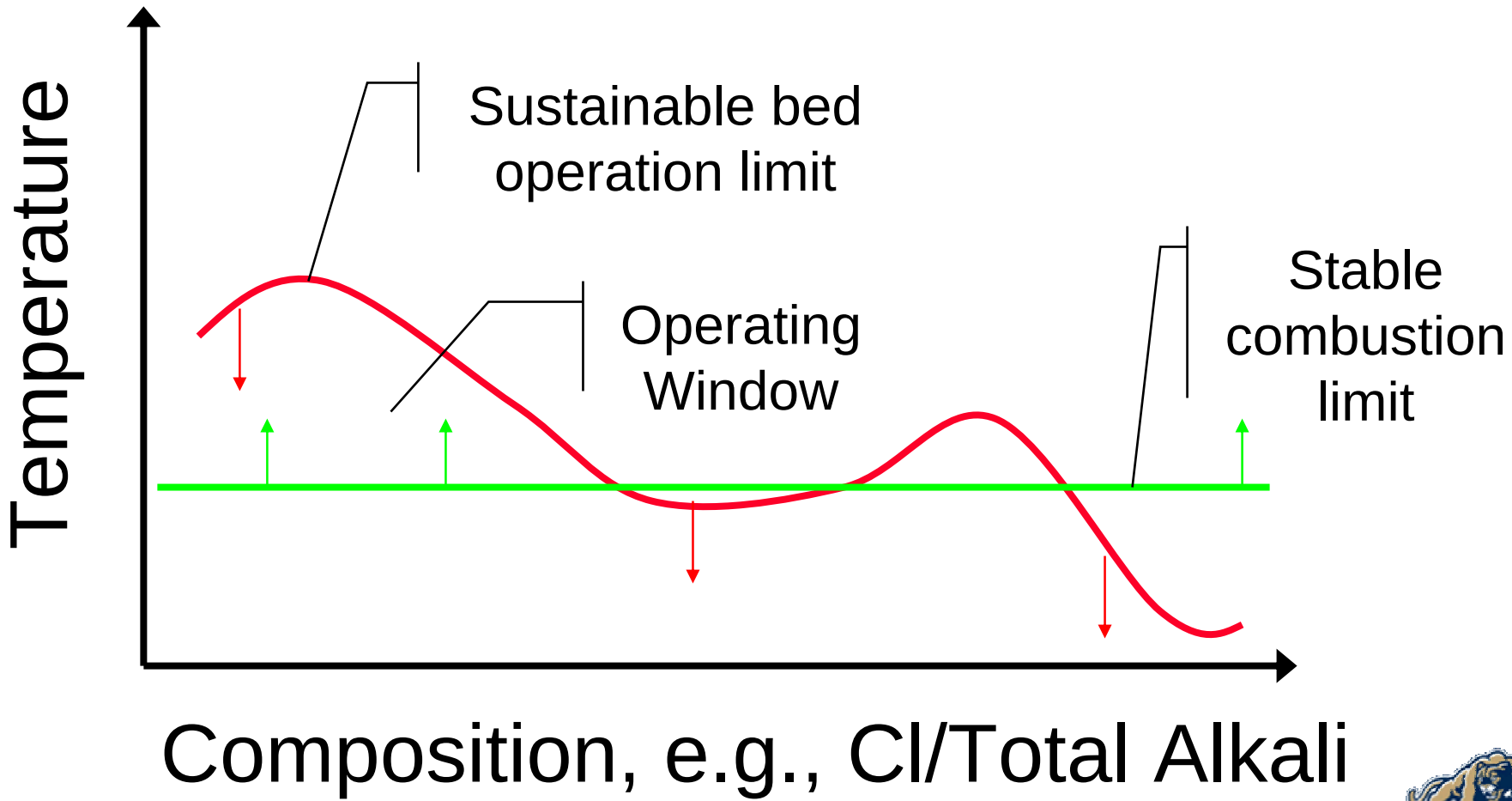
Cl



K & Cl



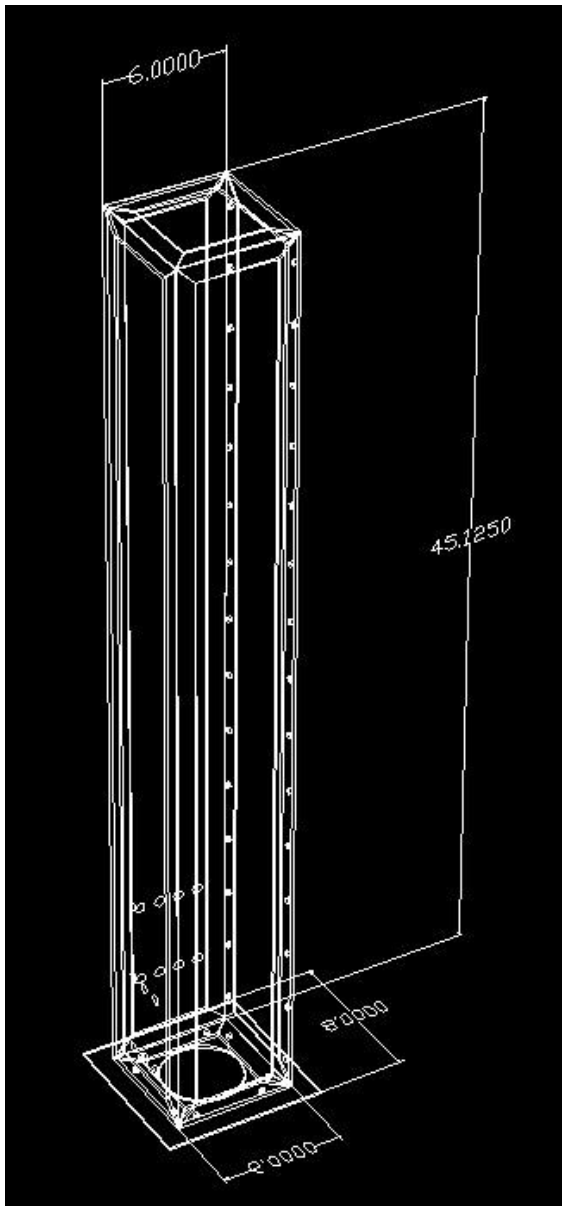
Conceptual Model

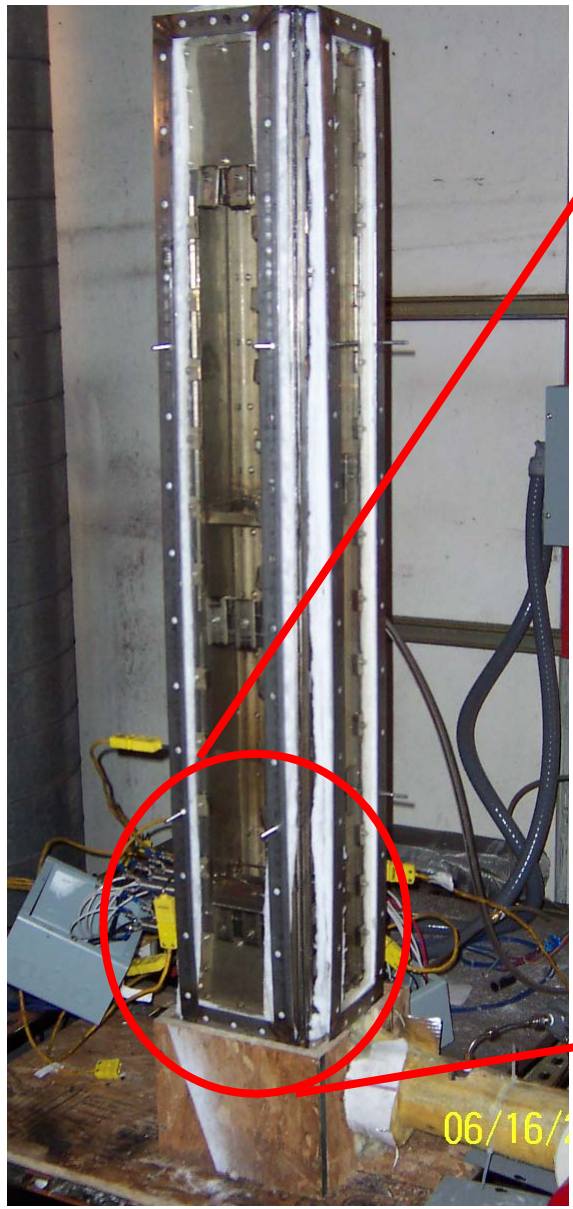


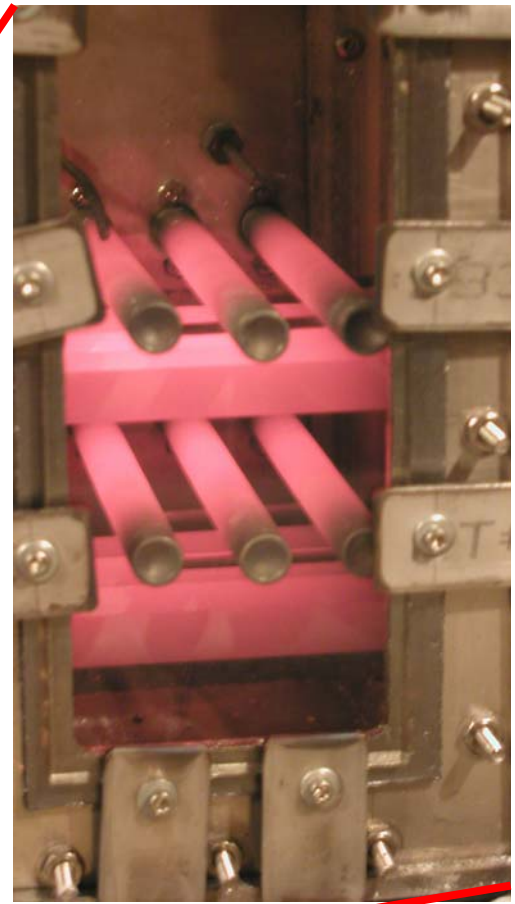
Test Matrix

Bed Material	KCl Impurity Concentrations [wt%]
Na_2CO_3	**0.0 (x3), 0.5, 2.0 (x2), 6.0 (x2), 10.0**
Na_2SO_4	**0.0, 0.5, 2.0**
Norampac	**0.0**
Georgia-Pacific	**0.0 (x2)**

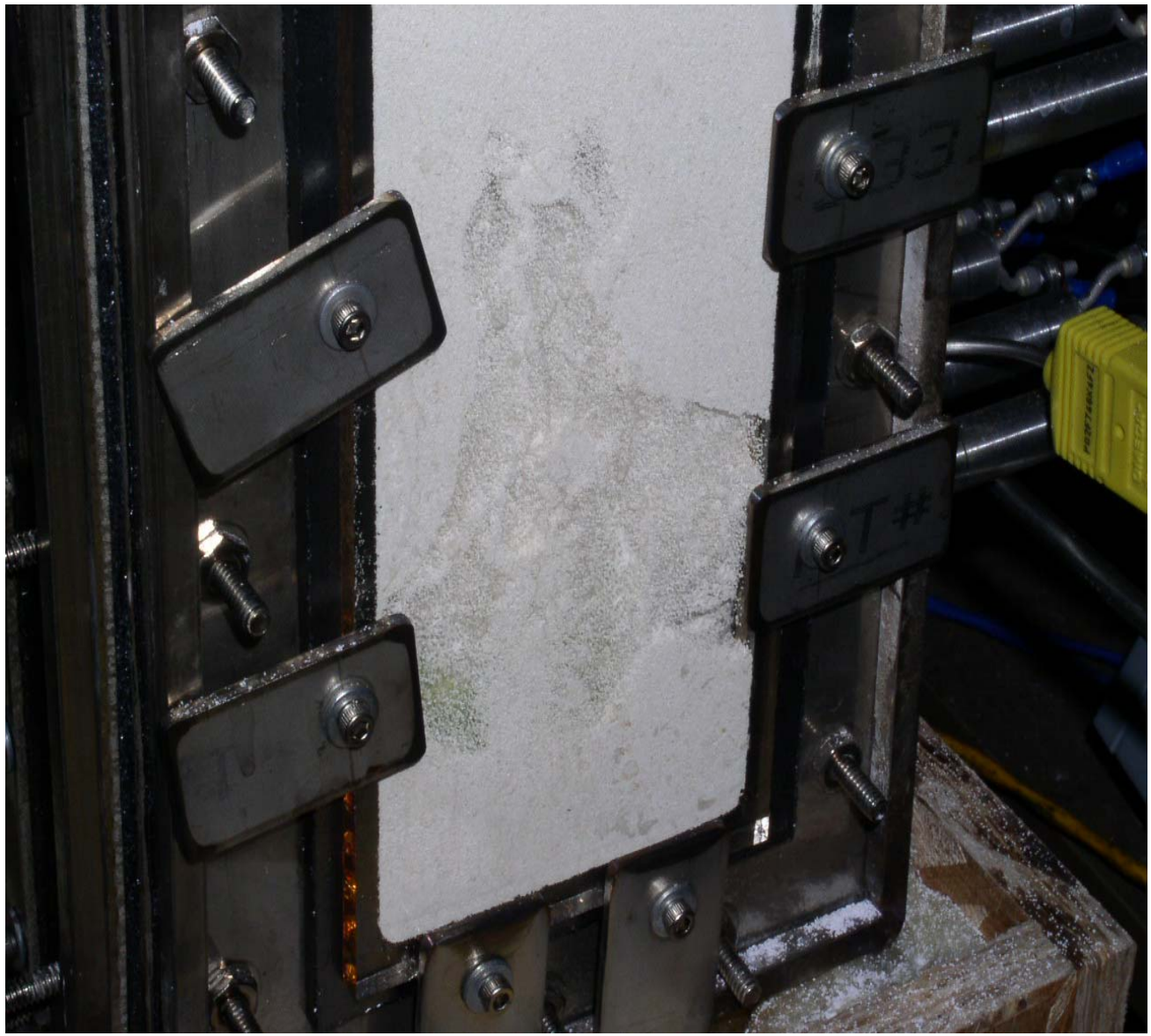
Laboratory Reactor



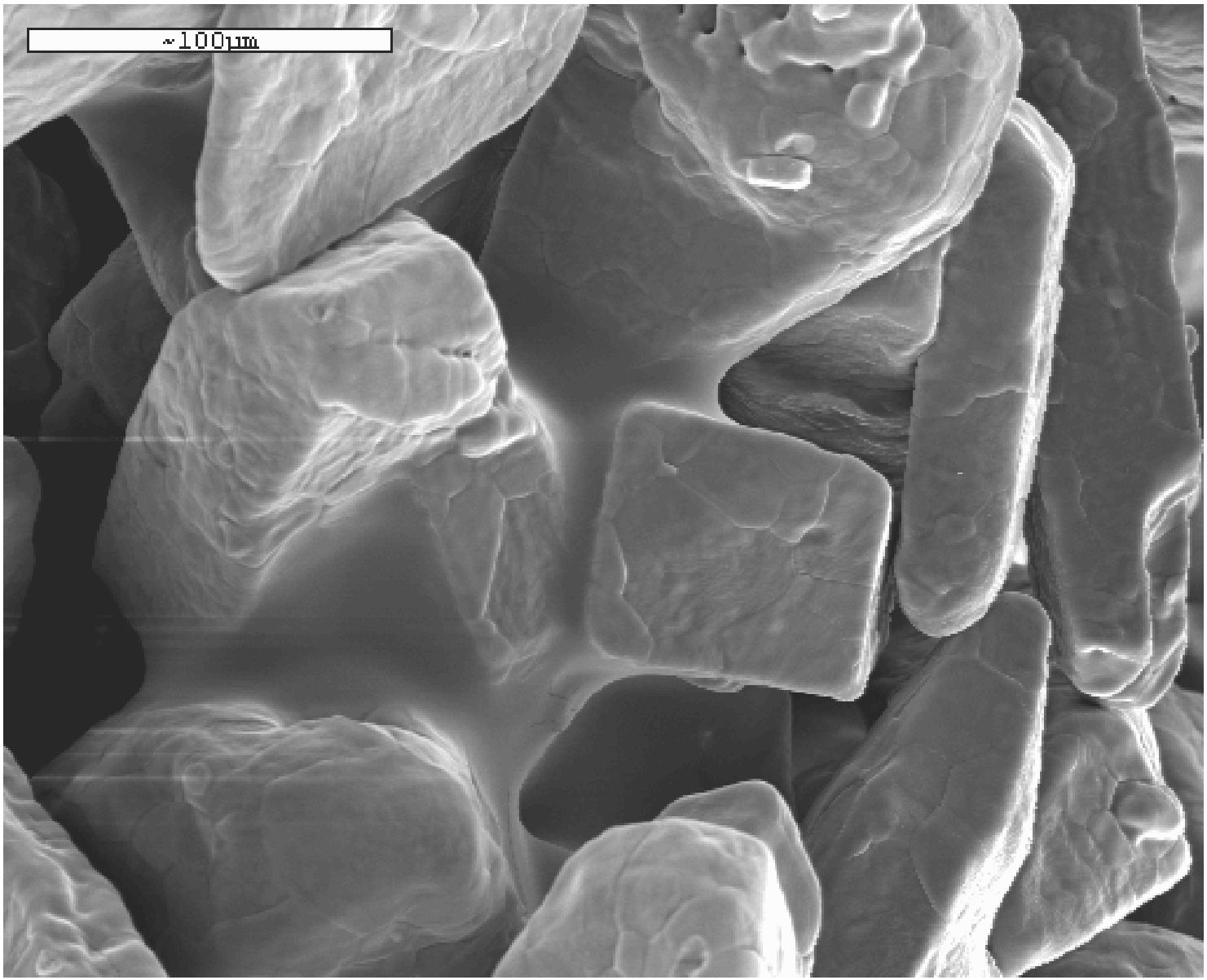




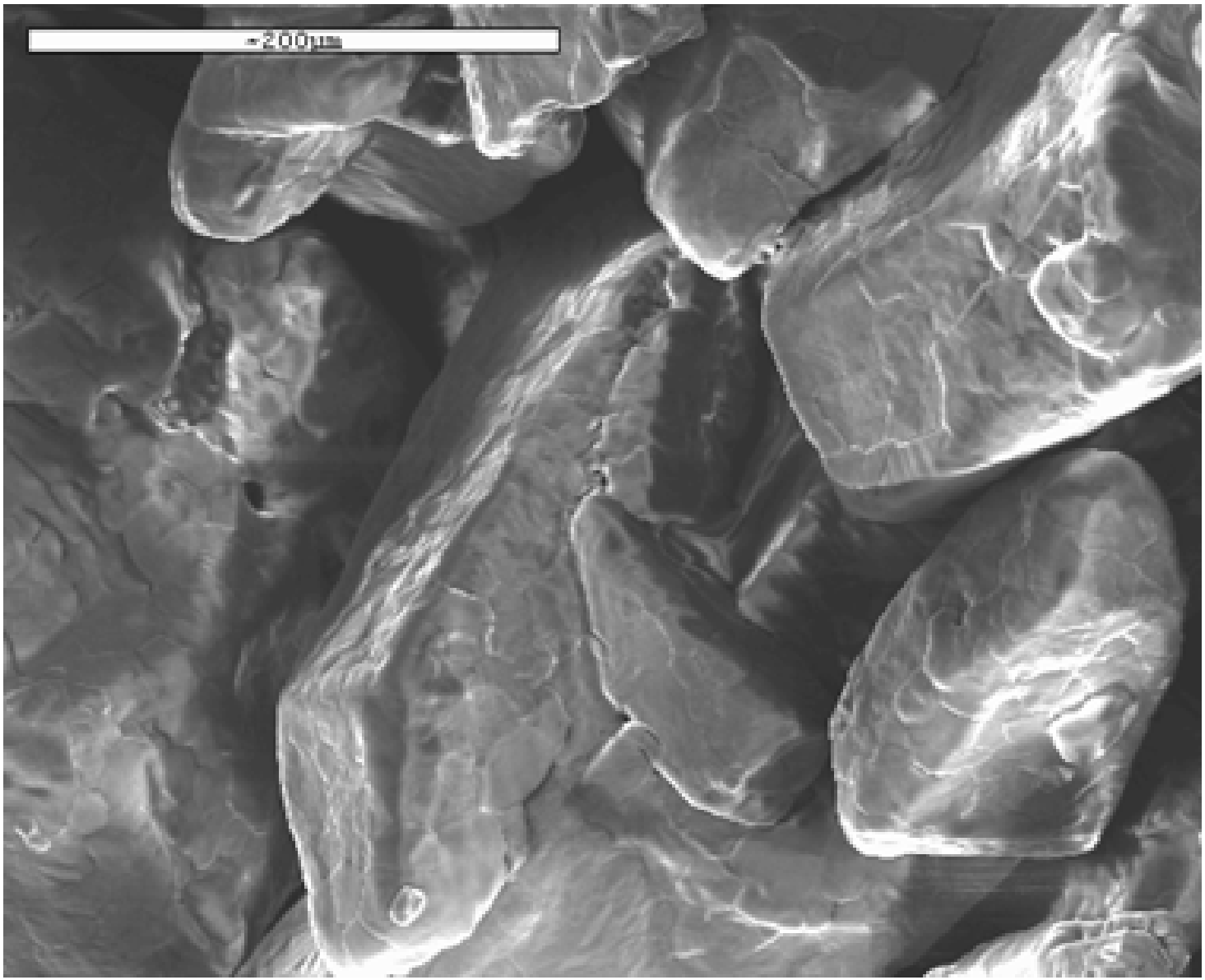
Fluidization Optical Access



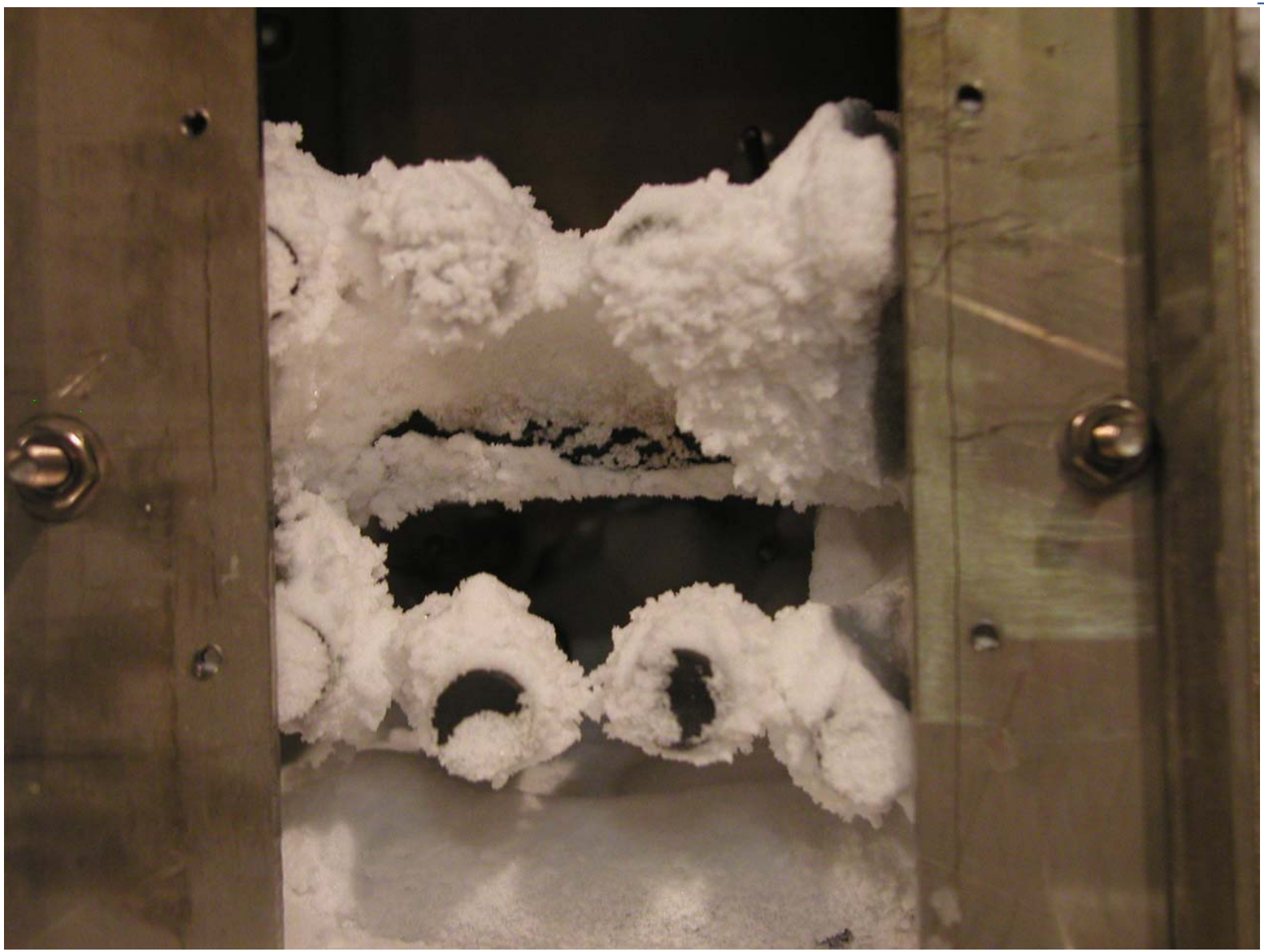
Sintering



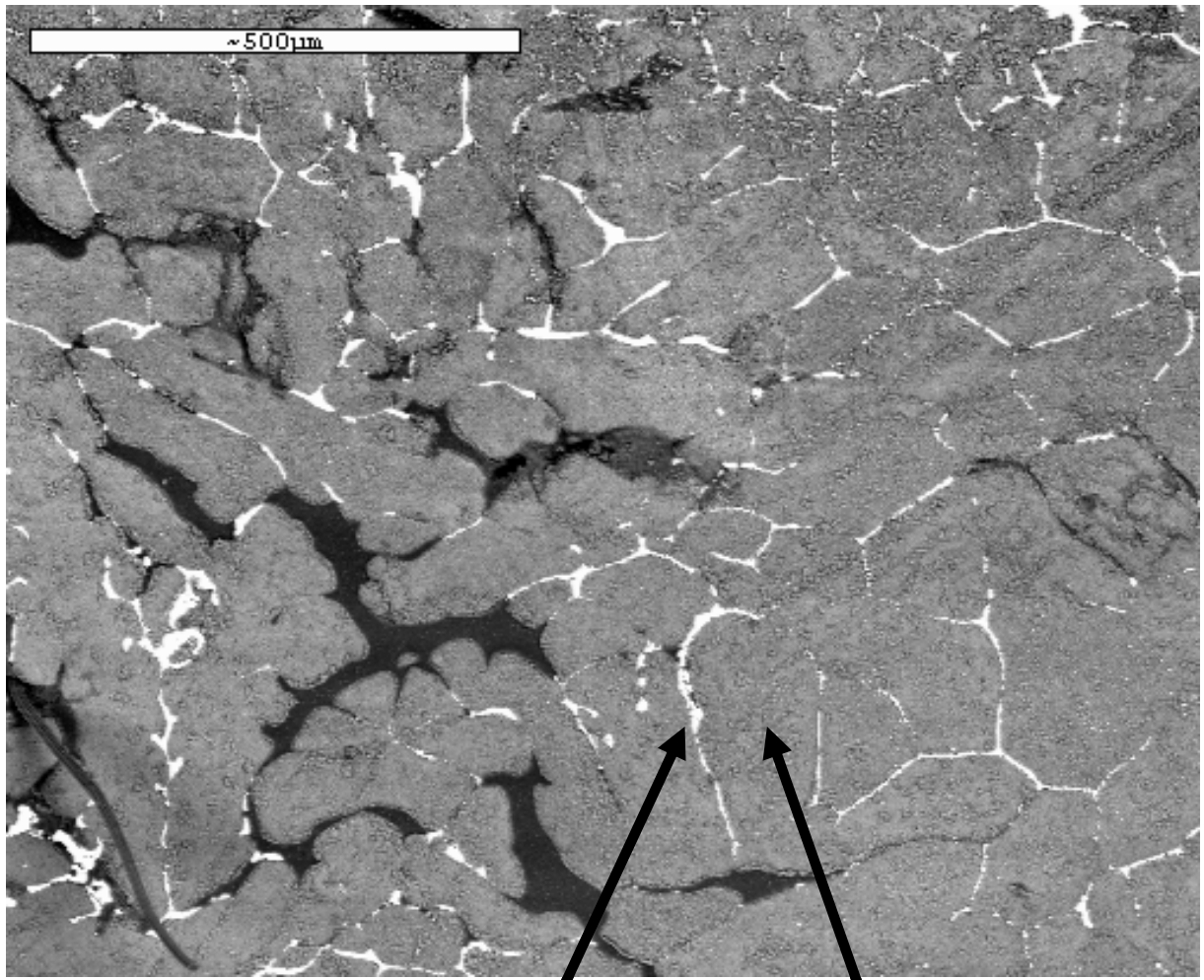
Minor Sintering



Agglomeration



Agglomerate Morphology

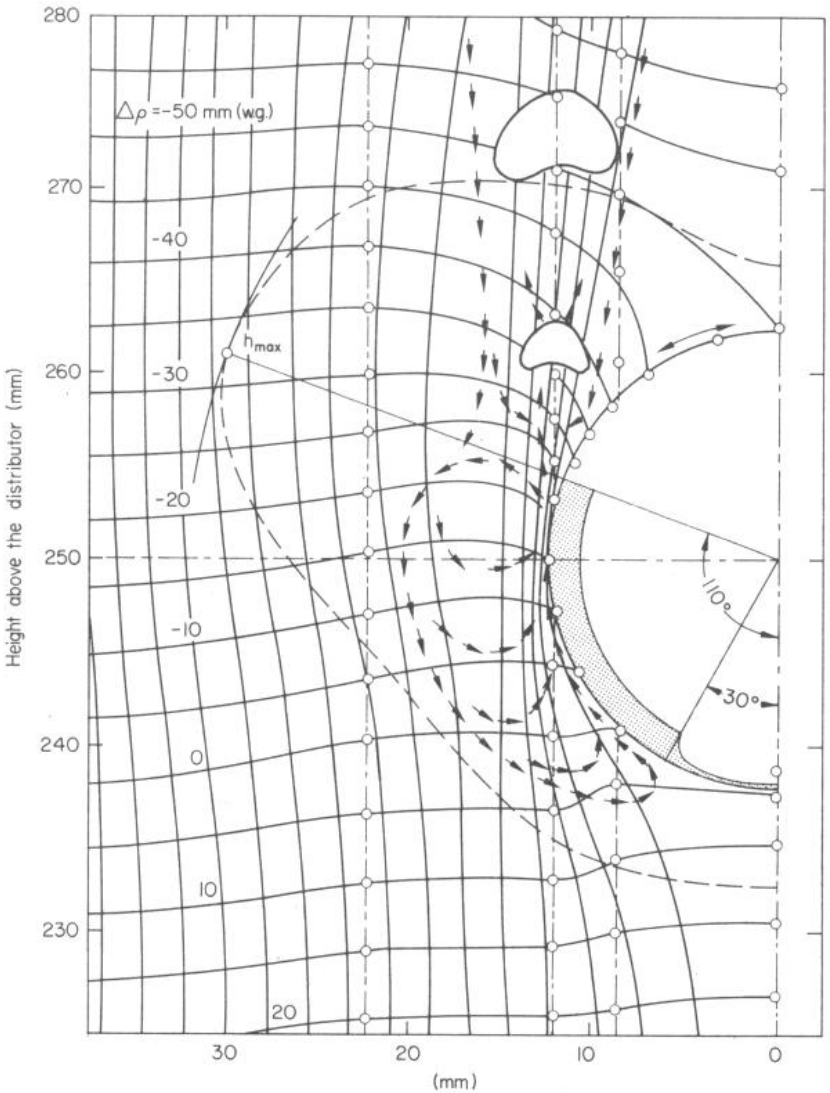


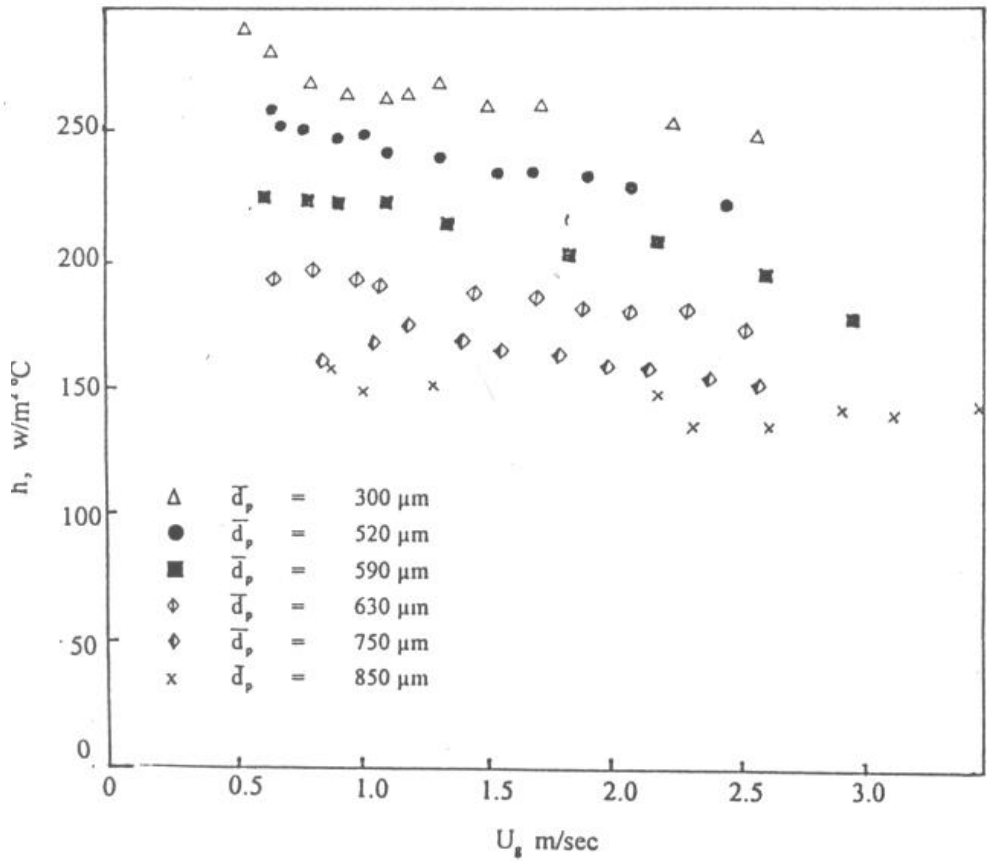
ΔT Indicates Sintering

$$T_{surface} - T_{bed} = \frac{P_{reactor}\,\dot{V}_{gas}\,\bar{c}_p \cdot (1 - \frac{T_{in,preheater}}{T_{bed}}) + Q_{radiation} + Q_{out,freeconvection}}{R_u h_{heater} A_{heater}}$$

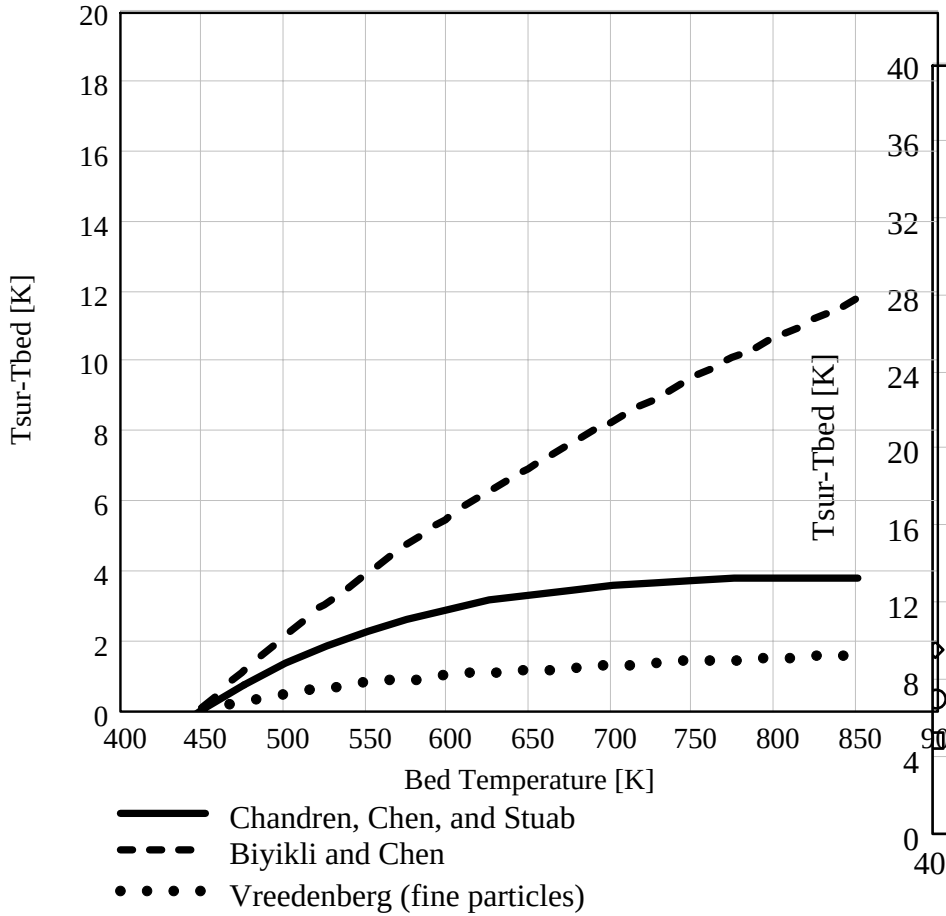
Temperature difference between bed and heaters is nearly independent of bed temperature unless particle size changes (sintering).

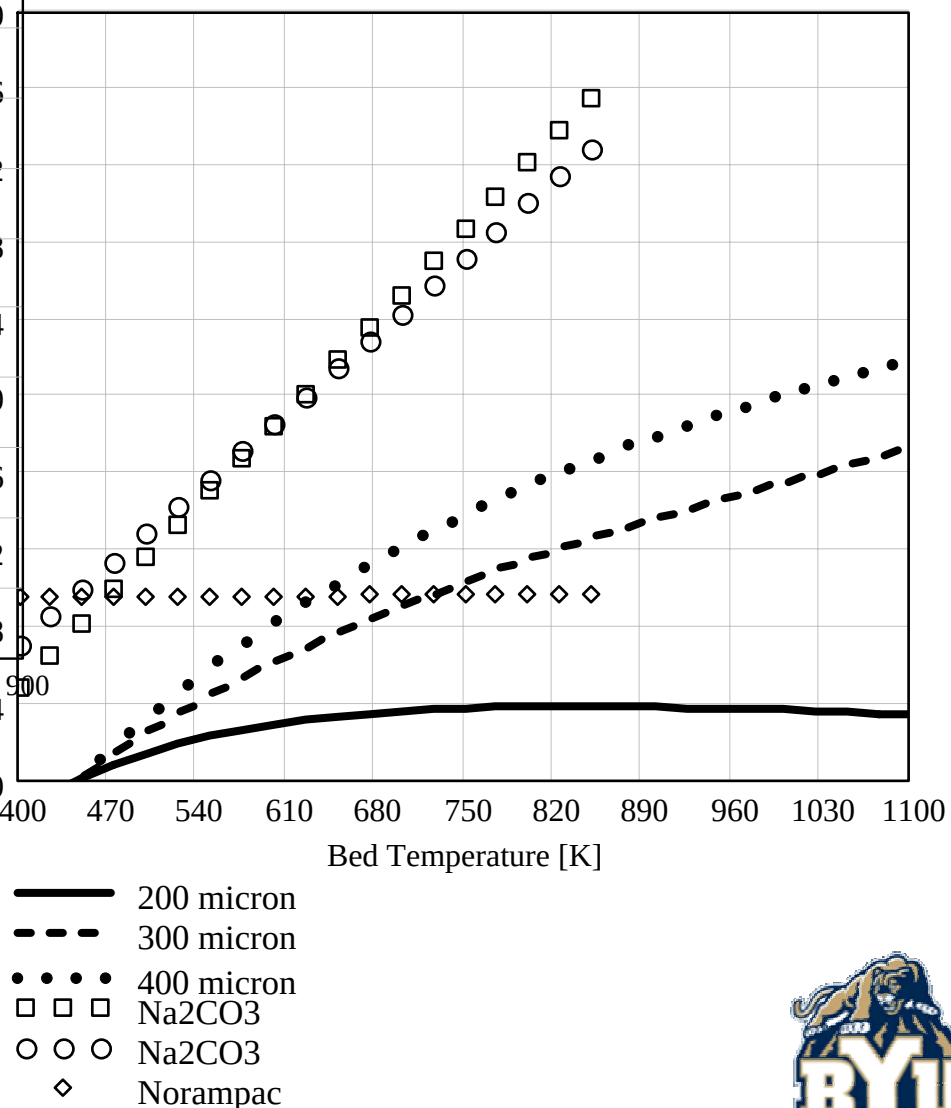
Heat Transfer Decreases w/ Size



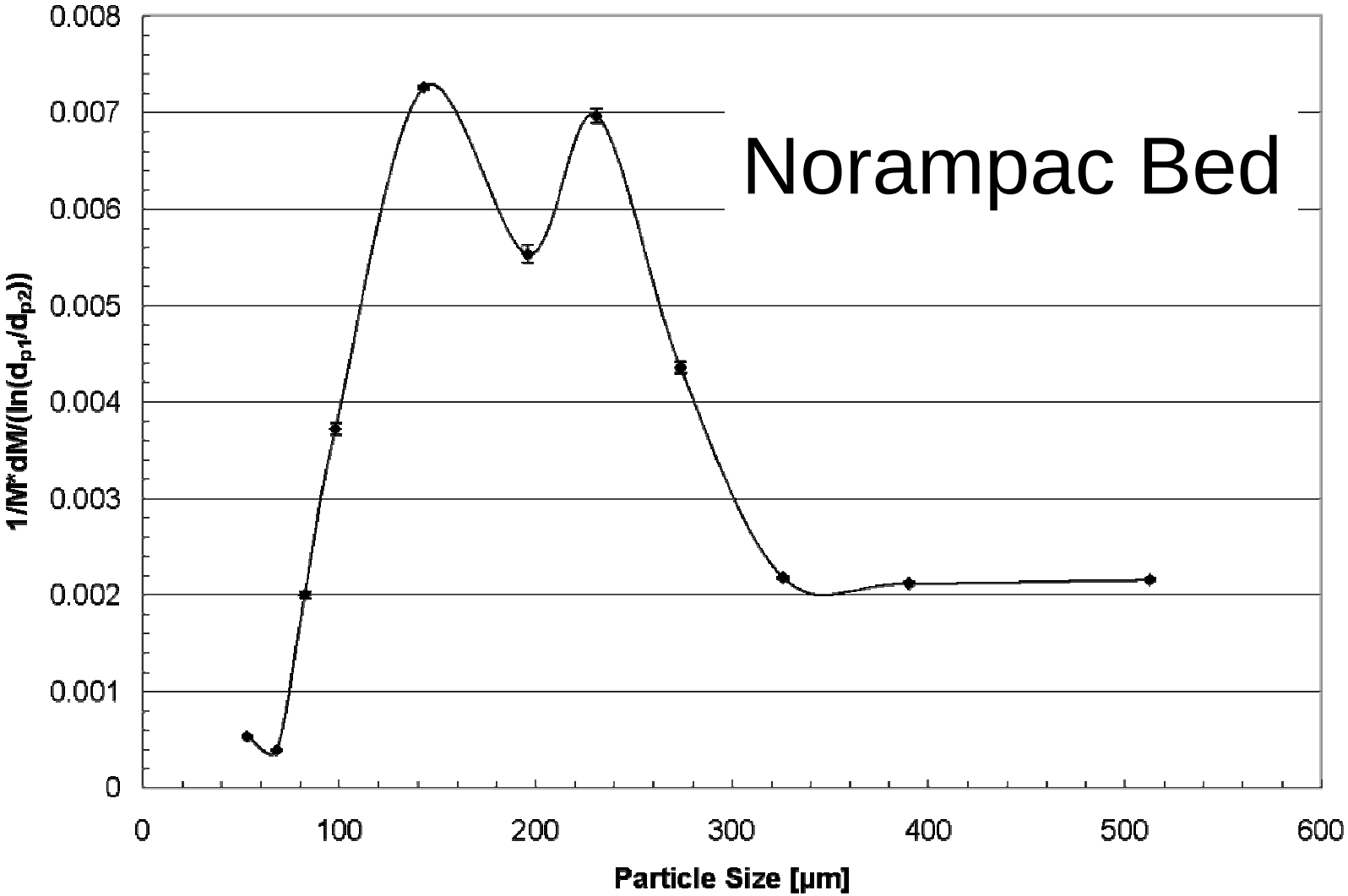


Carbon Coating Enables Technology

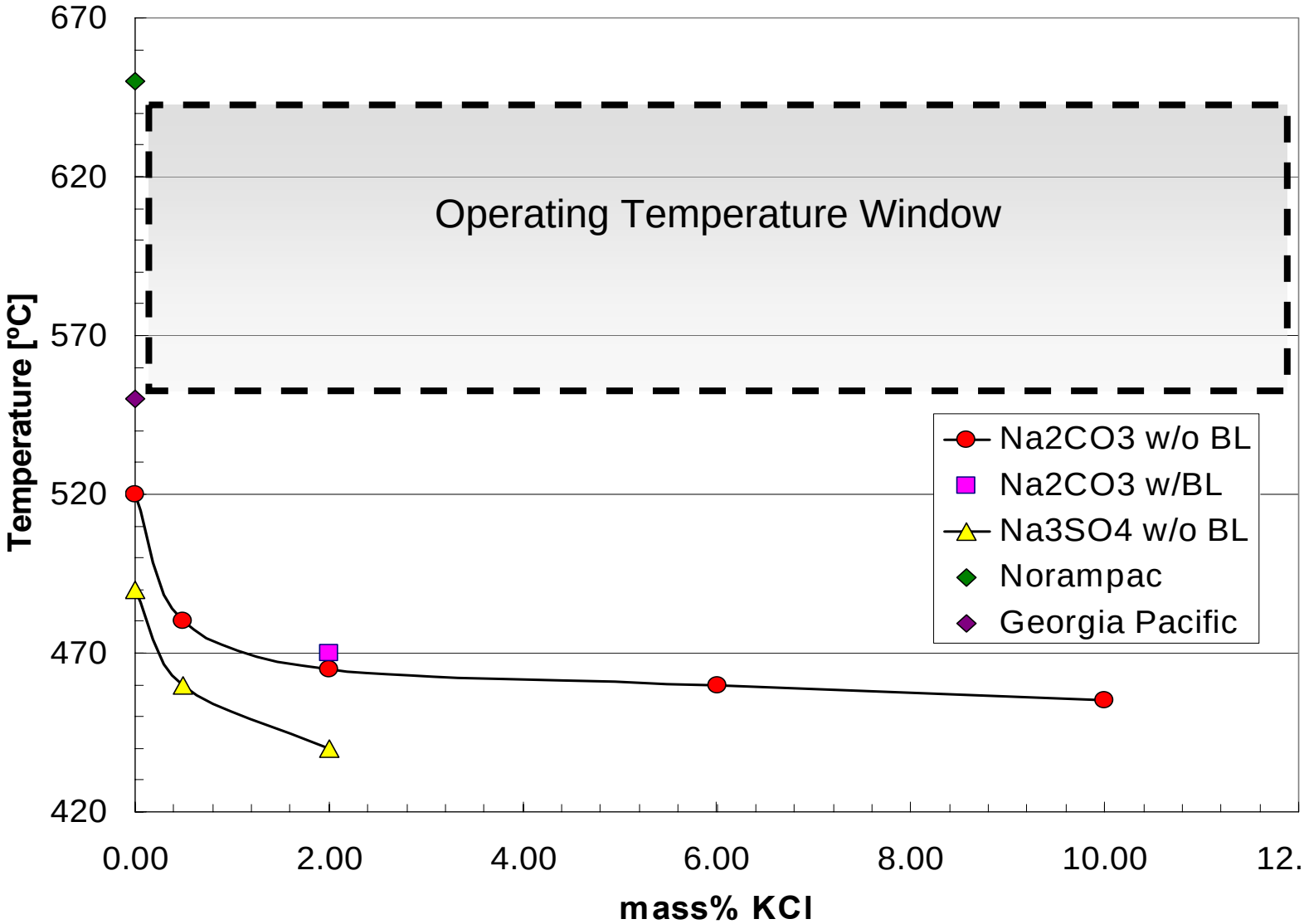




Particle Size Distribution Critical



Experimental Results



Conclusions

- Difference in bed and heater temperature provides useful information on changes in bed.
- Carbon coating critical to sustained fluid bed operation of black liquor gasifiers.
- Particle size distribution possibly equally critical.