



Utilization of Partially Gasified Coal for Mercury Removal

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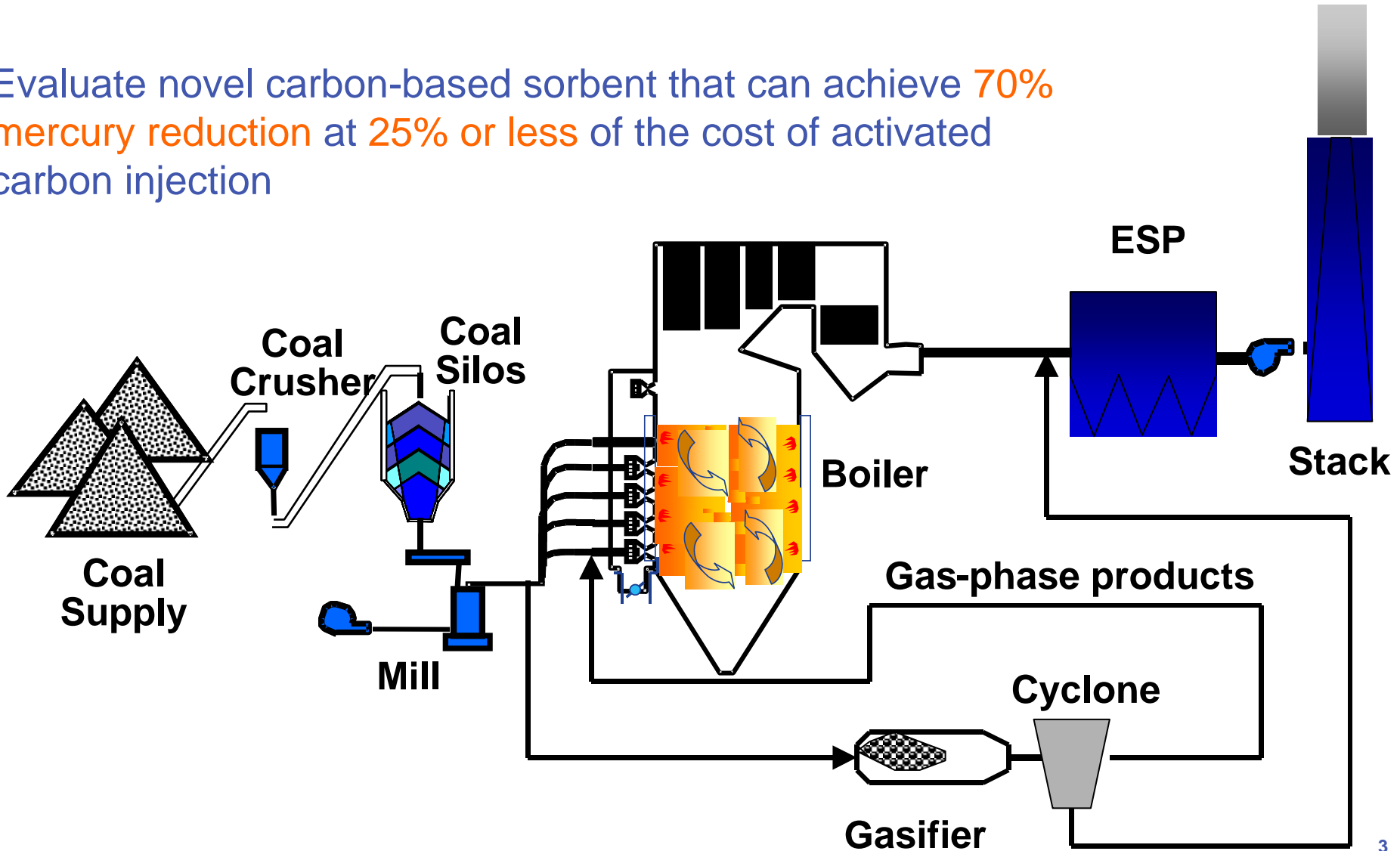


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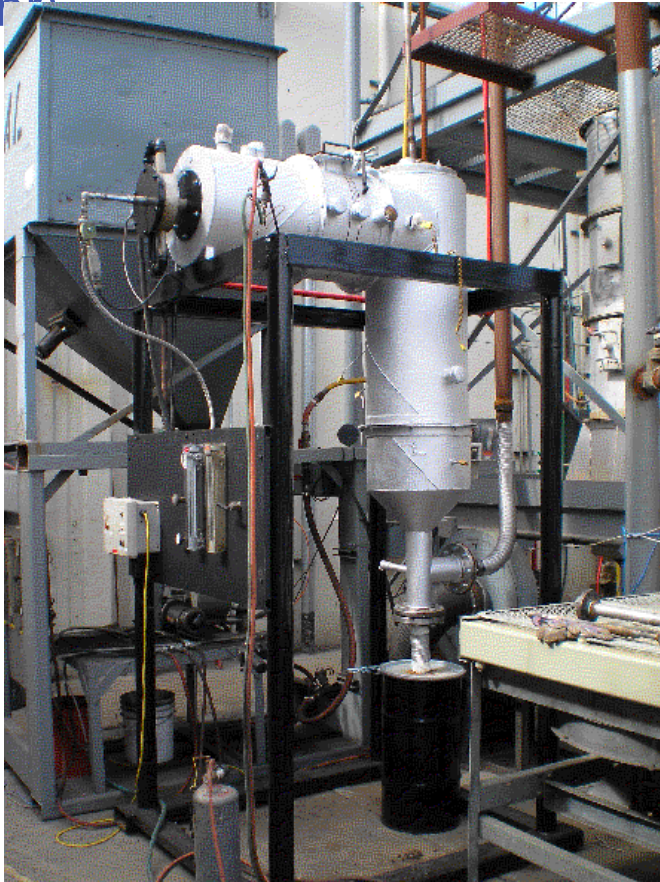
Project Objective and Approach

Evaluate novel carbon-based sorbent that can achieve **70% mercury reduction** at **25% or less** of the cost of activated carbon injection



Pilot-Scale Optimization

- Boiler simulator facility (1x10⁶ Btu/hr)
- Solid fuel gasifier (90,000 Btu/hr)



Located in Santa Ana, CA

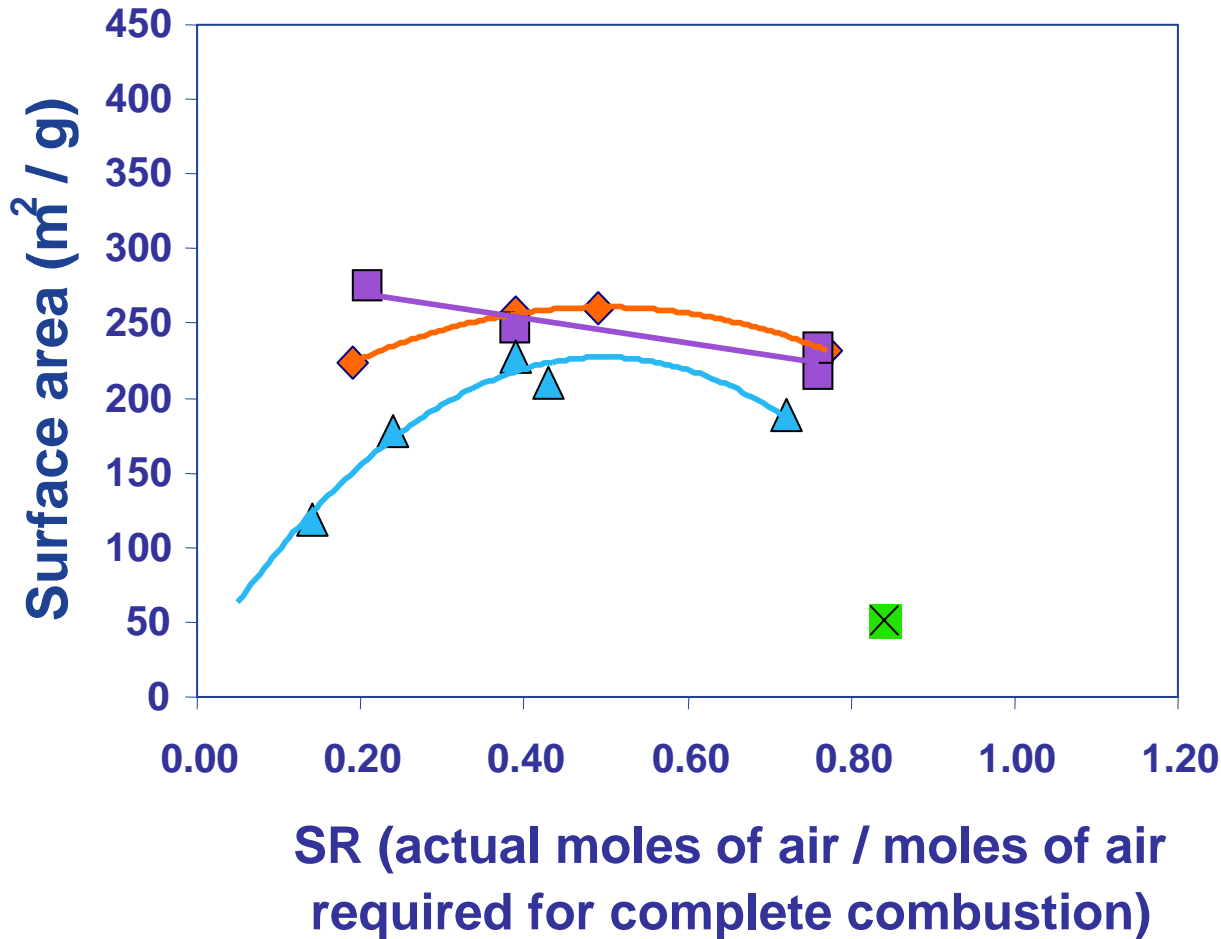
Gasification Optimization

Optimize Conditions:

- Stoichiometric Ratio in Gasification Zone
- Coal Residence Time in Gasification Zone
- Gasification Temperature

Effect of Air to Fuel Ratio: Coal #1

Surface Area Trends



Bituminous
Coal #1

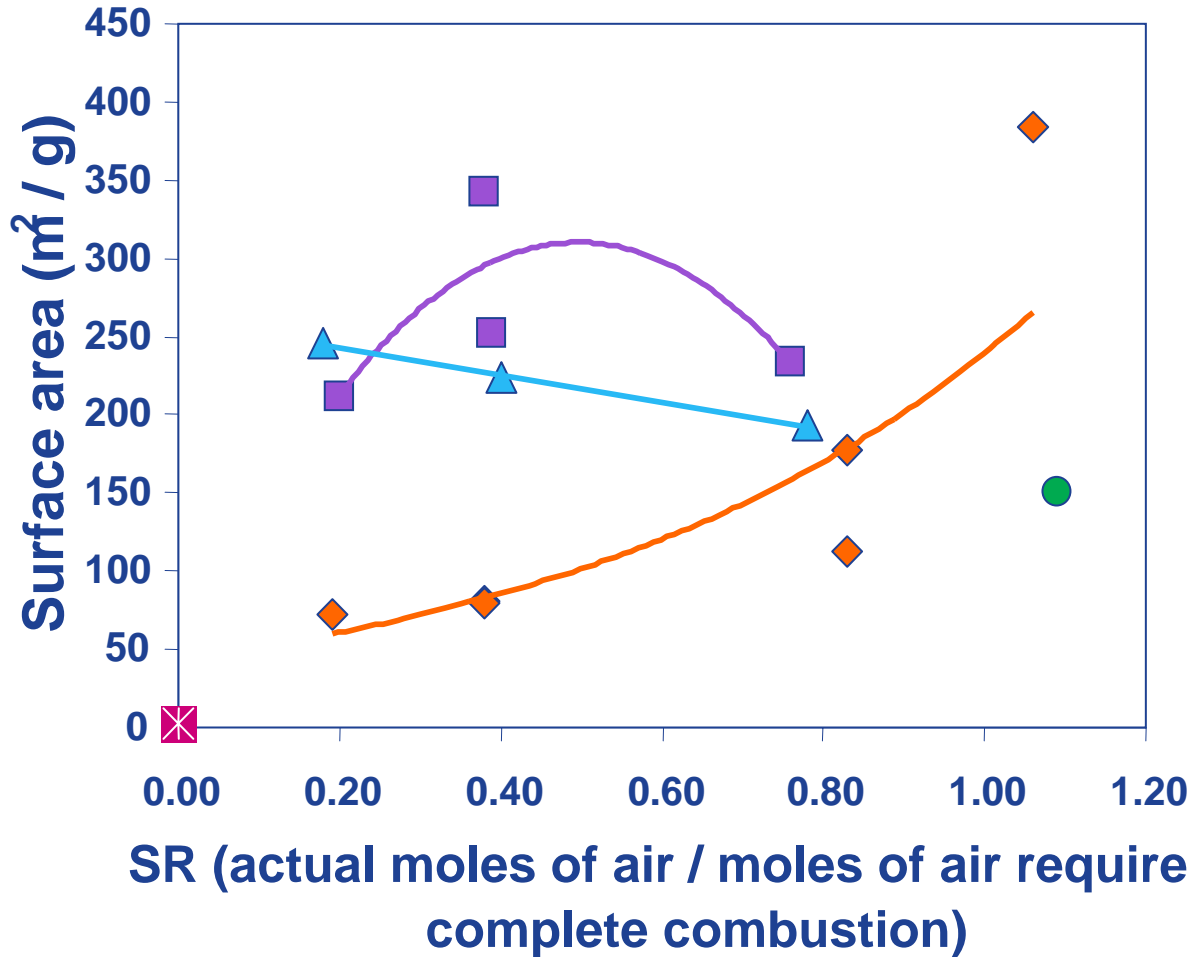
- ◆ $0.8 \leq \text{Res Time} < 1.2$
- $1.3 \leq \text{Res Time} < 1.7$
- ▲ $1.8 \leq \text{Res Time} < 2.2$
- ✕ Res Time ≥ 2.2

(Residence time in
seconds)

Optimum air to fuel ratio in the range of 0.4-0.6

Effect of Air to Fuel Ratio: Coal #2

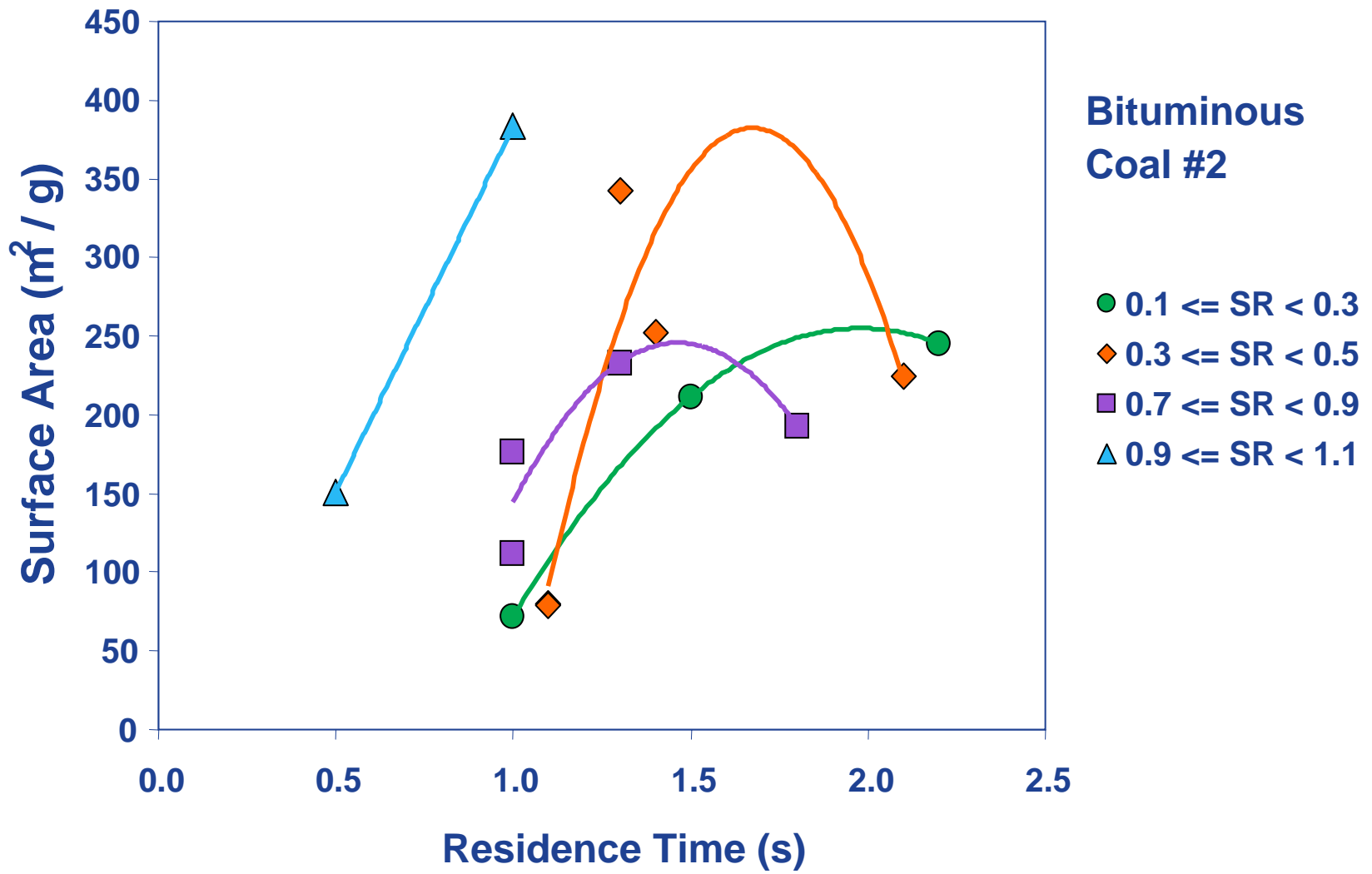
Surface Area Trends



Optimum air to fuel ratio depends on residence time

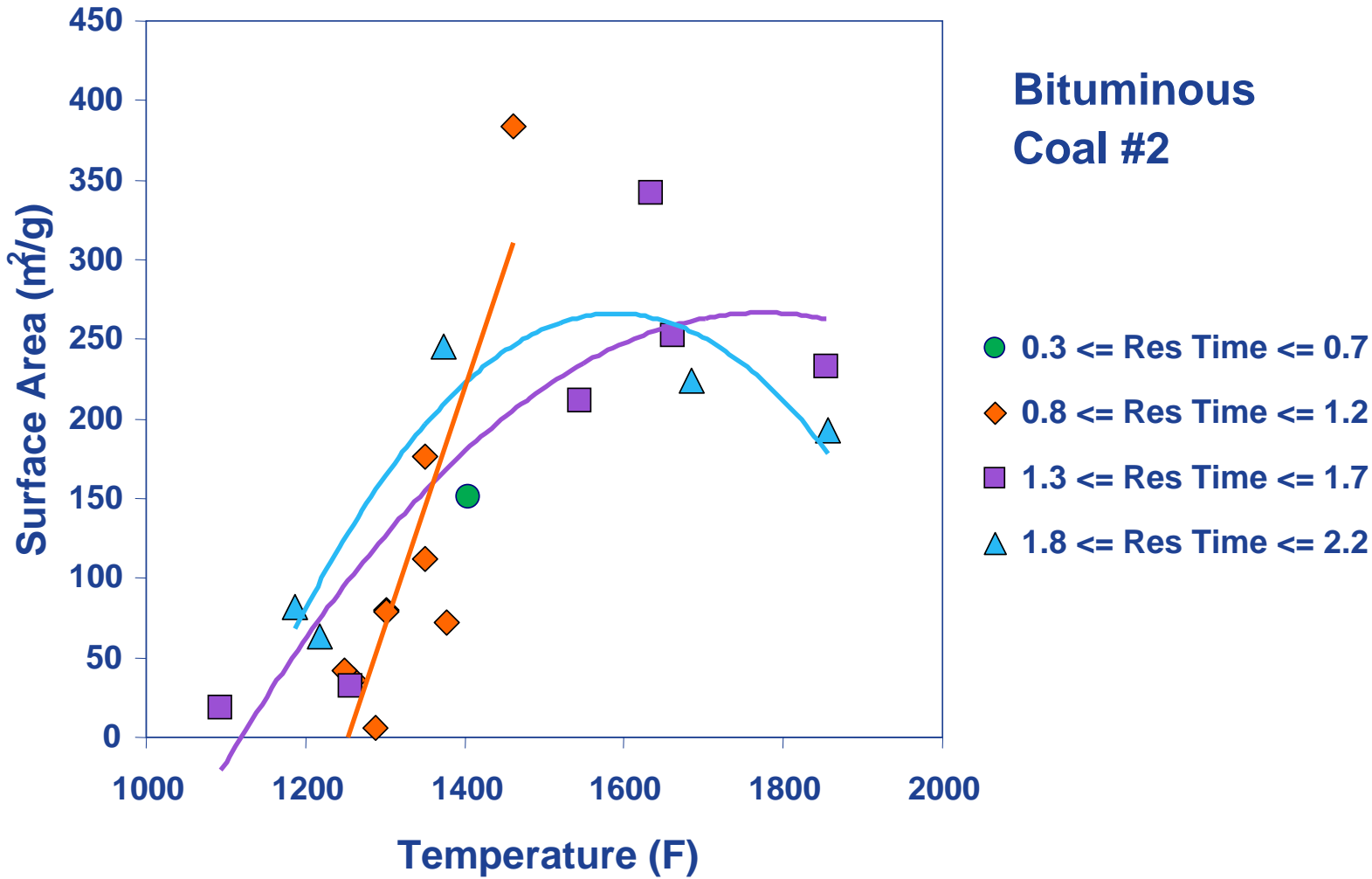


Effect of Coal Residence Time in Gasification



Optimum residence time depends on air to fuel ratio

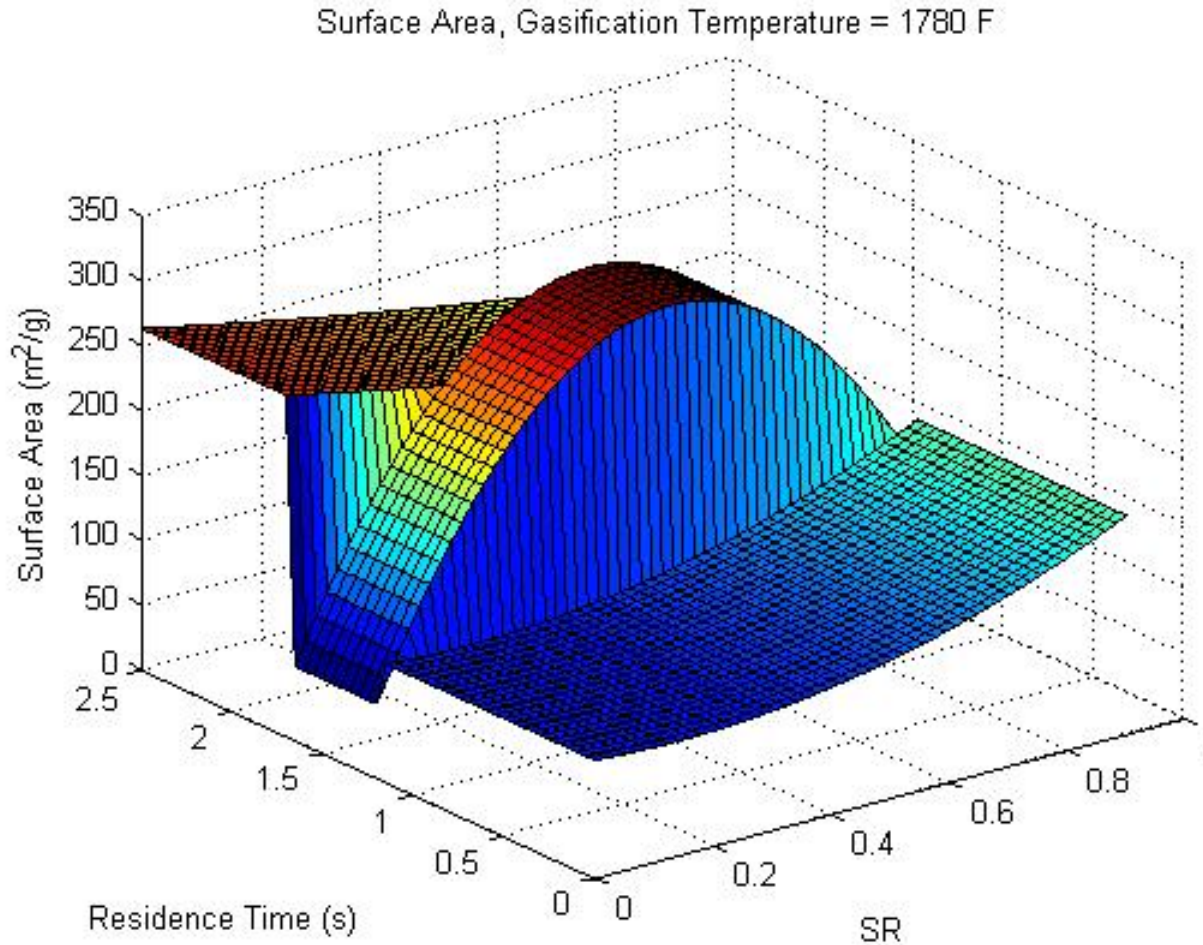
Effect of Gasification Temperature



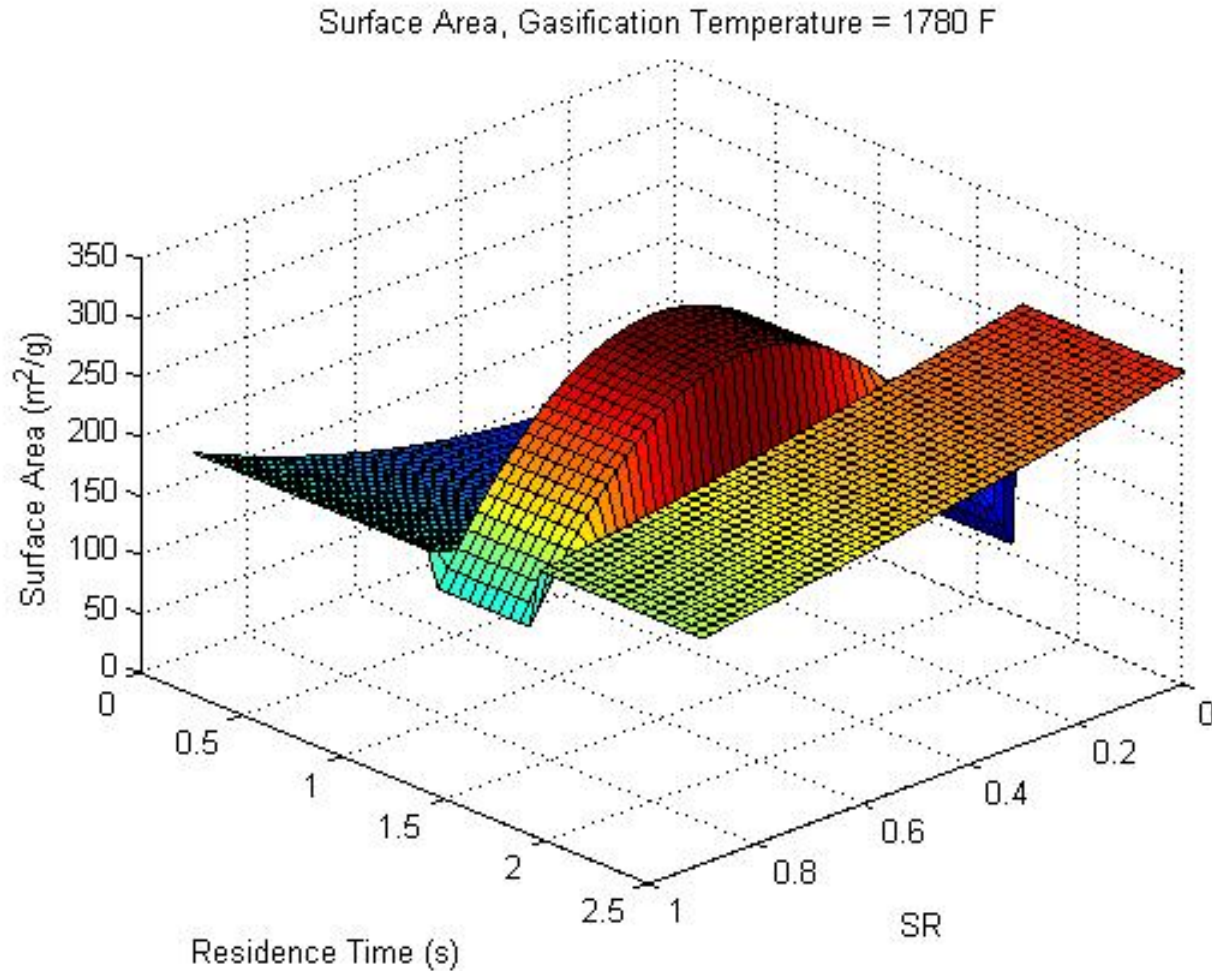
Optimum temperature in the gasification zone is a function of its residence time



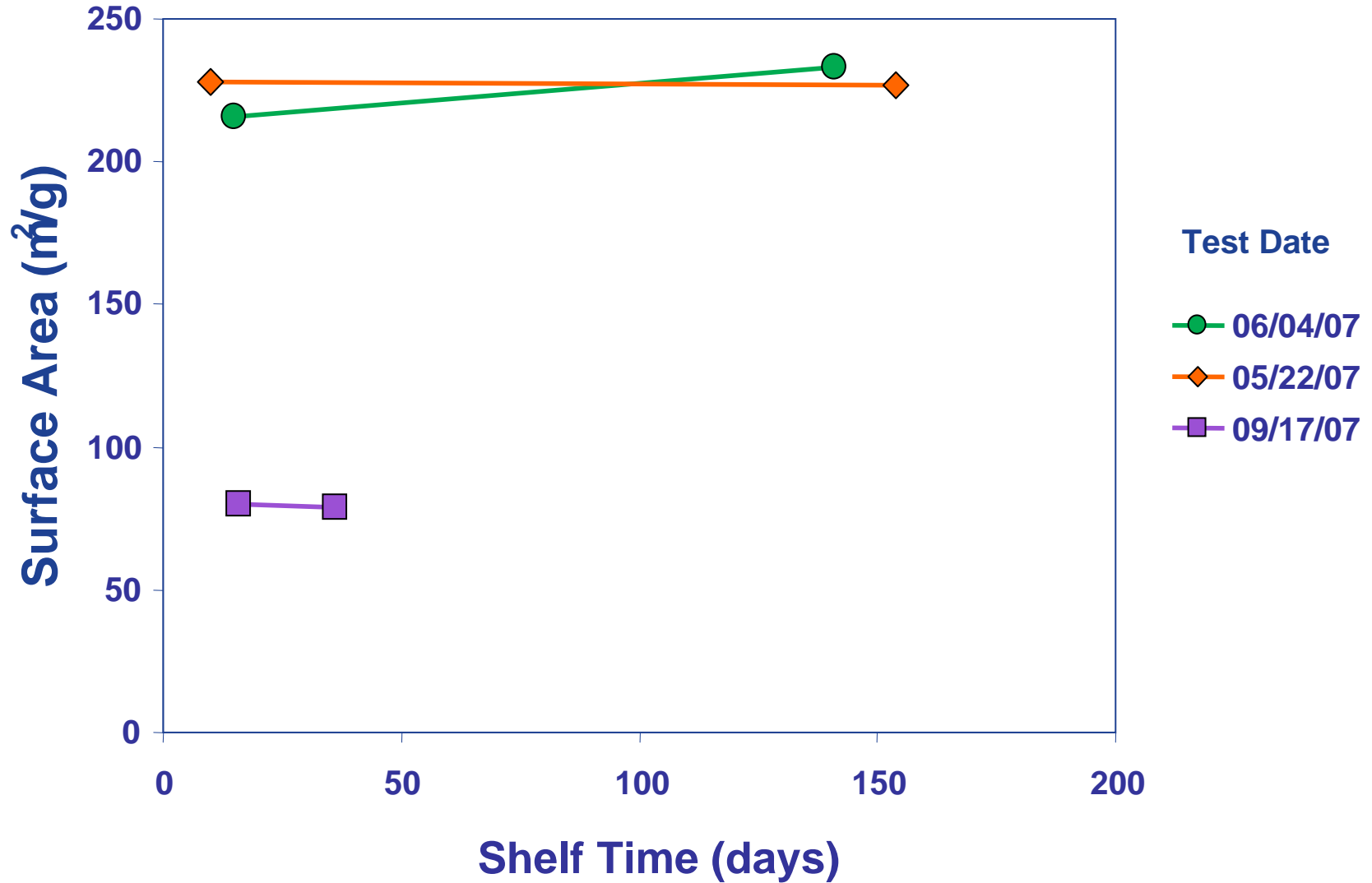
Optimization of Sorbent Surface Area



Optimization of Sorbent Surface Area



Effect of Shelf Time on Surface Area

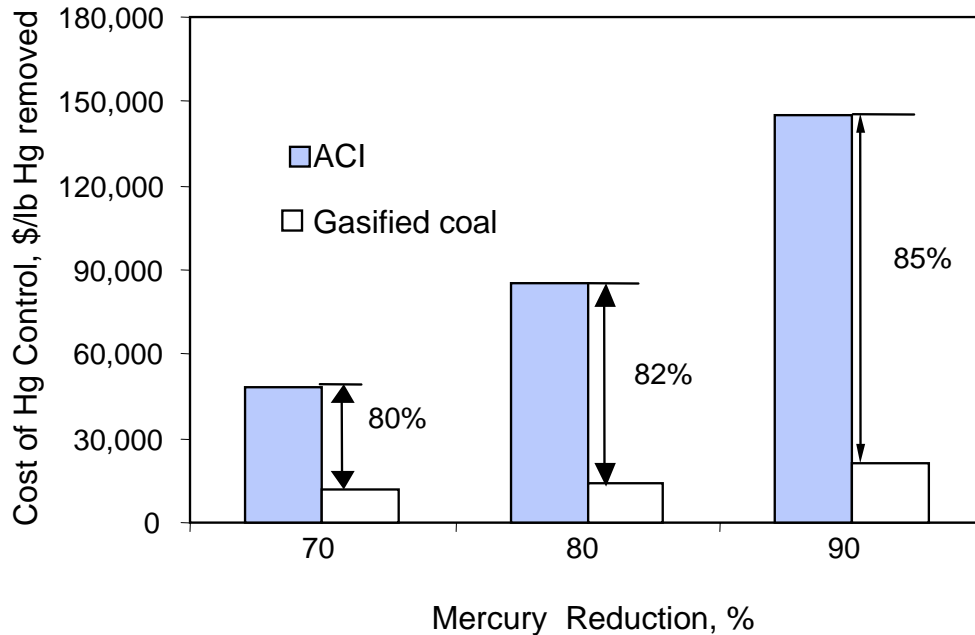


Sorbent properties are stable after 3 months of storage

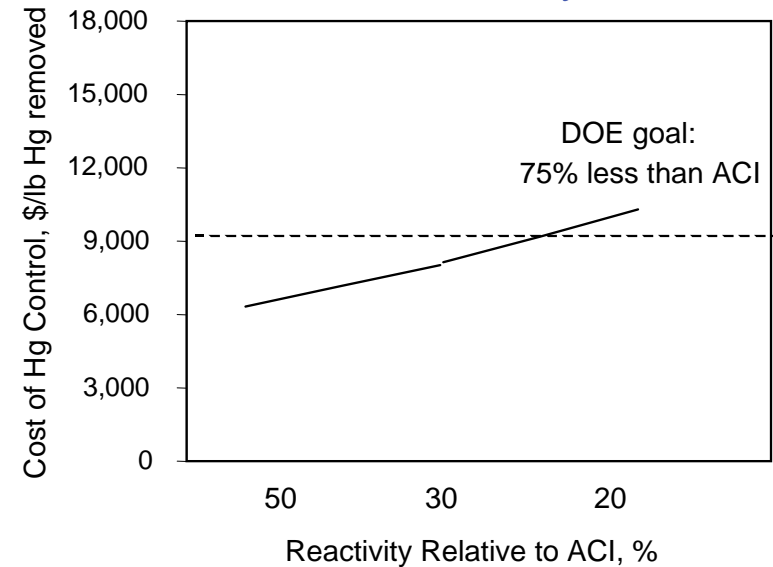
Economics*

- \$2M capital cost
- 50% less reactivity than ACI
- Bituminous coal
- ESP

Costs of mercury control using ACI and partially gasified coal



Effect of gasified coal reactivity on cost of 70% mercury reduction



Economic analysis suggests that the cost of 70% mercury control using partially gasified coal can be 75% less than ACI

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Project Summary

- Partially gasified coal has a surface area up to 400 m²/g
- Surface area of the partially gasified coal is affected by conditions in the gasification zone
- Optimum conditions in the gasification zone are affected by coal properties
- Mercury reduction tests using injection of partially gasified coal will be conducted in in Q1 2008