Overview of Factors Affecting Fouling in Recovery Boilers

Honghi Tran
University of Toronto

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Three Principal Parameters Determining the Rate of Fouling

- Particle Concentration
- Particle Stickiness
- Sootblowing Efficiency

Deposition

- Low Conc.
- Less Sticky
Types of Particles

- Fume: 0.5 µm (0.1 - 1 µm)
- ISP: 20 µm (1 - 100 µm)
- Carryover: 500 µm (100 µm - 3 mm)
ISP Covered with Fume
Three Principal Parameters Determining the Rate of Fouling

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Factors Affecting Carryover Concentration

- Firing load
- Air flow rate and distribution
- Black liquor properties
- Black liquor sprays
  - Nozzle design
  - Liquor temperature and pressure
  - Liquor properties
Liquor Spray Study at Domtar Espanola
May 2, 2003

Three Principal Parameters Determining the Rate of Fouling

- Particle Concentration
- Particle Stickiness
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Factors Affecting Carryover Stickiness (Liquid Content)

- Particle composition
  - Black liquor composition (Cl, K)
  - Black liquor droplet size
- Particle temperature
  - Flue gas temperature
  - Retention time
  - All burning particles are sticky!

U of T Entrained Flow Reactor
Effect of Particle Size on Deposition

Mill “A” Black Liquor
EFR Temp. = 800°C
Prediction of Sticky Temperature

Black Liquor Composition

Particle Composition

Sticky Temperature
Carryover Particle Composition Continuously Changes

- Cl, K and carbonate contents are lower than previous thought
- S (sulphate and sulphide) content is higher
- Changes depend strongly on particle size, temperature and excess O₂
Factors Affecting Sootblowing Efficiency

- Sootblower nozzle design
- Blowing sequence and frequency
- Deposit adhesion strength
  - Composition
  - Tube temperature
- Tube arrangement
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Deposit Removal Studies

- Laboratory studies
  - Composition
  - Tube surface temperature
  - Particle size
- Numerical simulation
  - Free jet
  - Jet-deposit interaction
- Field studies
  - Sootblowing efficiency
**Effect of Chloride on Removal**

![Graph showing the effect of chloride on removal with probe temp. = 400°C, 0% K, and % CO₃.](image)

**Effect of Potassium on Removal**

![Graph showing the effect of potassium on removal with probe temp. = 400°C, 0% CO₃, 5 mole% Cl/(Na+K), and 2 mole% Cl/(Na+K).](image)
Air Jet Impingement Apparatus

Sootblowing Efficiency Studies at Domtar Espanola
May 2, 2003
Conclusions

- Particle Concentration
- Particle Stickiness
- Deposition

- Fouling/Plugging
  - Low Conc.
  - Less Sticky

- Sootblowing Efficiency
  - High Efficiency
Deposition

Particle Concentration

Particle Stickiness

Sootblowing Efficiency

Low Conc. → Less Sticky

Fouling

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