



'Metallurgical Failures in Fossil Fired Boilers' Curriculum Overview

Day 1 Agenda

Instructor: Dr. David N. French

Day 2 Agenda

I. Boiler Operation & Design

- Rankine Cycle
- Boiler Circulation
- Heat Transfer
- Boilers
- Fuel Considerations and Effects on Design

II. Material of Construction

- Waterwalls
- Superheaters and Reheaters
- Headers
- Drums

III. Materials Selection

IV. Fundamentals of Ferrous Metallurgy

- Physical Metallurgy
- Mechanical Properties

V. Microstructural Changes

- Carbon Steel; Pearlite, Spherodite, and Graphite
- Stainless Steel; Carbide Precipitation & Sigma Phase

VI. Failures & High Temperature Microstructures

- Bainite, Widmanstätten, Martensite
- Use of Lever Rule to find temperature at failure creep and creep failures
- Stainless Steel, Sigma phase formation, carbide precipitation, grain growth

VII. Gas-Metal Reactions

- Scale formation
- Effects of ID scale on OD Temperatures
- Thermal analysis
- Exfoliation

I. Corrosion

- Electrochemical nature, dry cell, anode/cathode reactions
- Uniform Attack
- Pitting - oxygen pitting
- Fretting
- Erosion/ Corrosion
- Intergranular Corrosion
- Corrosion Fatigue
- Stress Corrosion Cracking
- Caustic Gouging

II. Water Treatment

- Deposit Formation
- Hydrogen Damage
- Copper Deposits

III. Lay-up Procedures

IV. Fireside Corrosion

- Combustion Elements
- Ash Constituents
 - Coal
 - Oil
 - Gas

V. Welding Problems & Solutions

VI. Remaining Life Assessment

VII. Special Topics

- Real Case Analysis
- Question and Answer Session