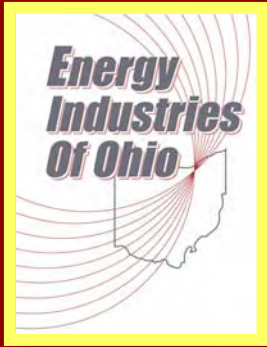


Improving the System Life of Basic Oxygen and Electric Arc Furnace Hoods, Roofs and Side Vents

Lawrence C. Boyd Jr.
Manager, Core Programs
Energy Industries of Ohio

Cleveland, OH
January 23, 2008



EAF / BOF Project

⇒ Funding:

- ⇒ US DOE via the ODOD-Energy Office
- ⇒ Participants – EIO, Oak Ridge National Lab, Ohio Steel Cos.

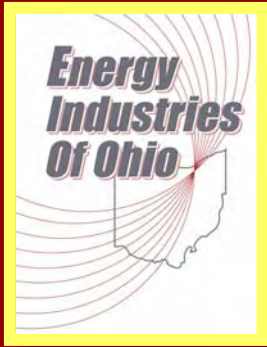
⇒ Objective

- ⇒ Industry Defined Life of Water Cooled Components in Steel Manufacture as a Roadblock to Increased Efficiency/Productivity.

⇒ Goal: Improve System Life EAF/BOF Equipment

⇒ Targets:

- ⇒ 2 x Service Life
- ⇒ 20% Life Cycle Cost Improvement
- ⇒ 95% Reduction in Routine Maintenance



Work Plan

⇒ Survey of Current Practice

⇒ Project Participants

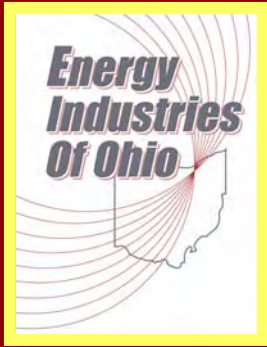
⇒ AISE 1999 Survey

⇒ Plant Visits and Interviews

⇒ Results

⇒ Industry still uses Carbon Steel
and Low Alloy Steel

⇒ Repairs Still done by cutting out
damaged sections and welding



Work Plan

⇒ Identification of Alternatives

⇒ Coatings

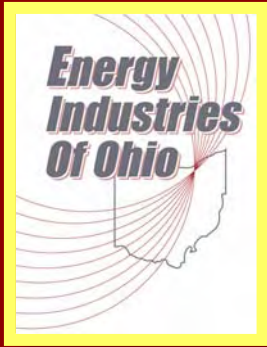
⇒ Industry View: Too Fragile for This Service

⇒ Weld Overlays

⇒ Industry View: Proven Options Already Exist

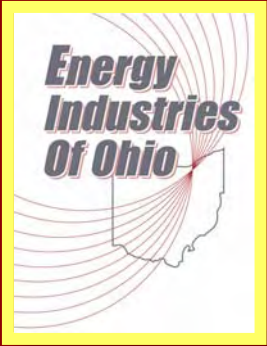
⇒ New Alloys

⇒ Industry View: Best Solution if Alternatives Can Be Identified

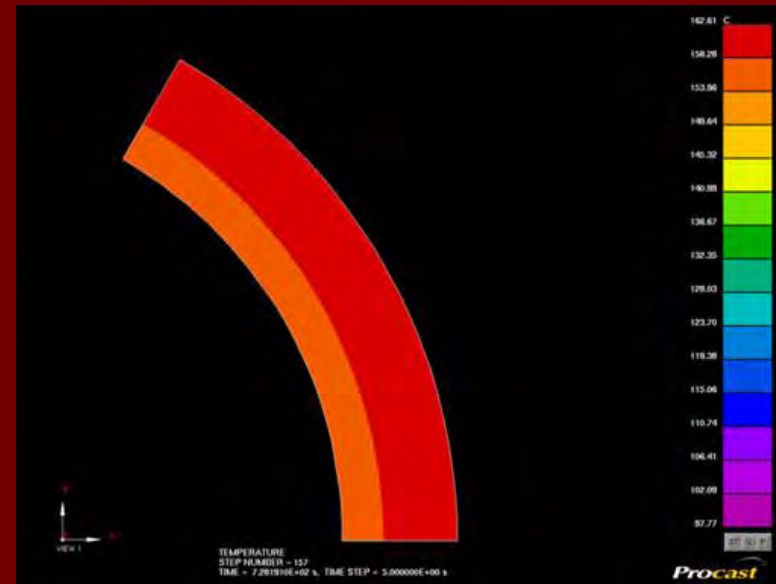


Work Plan

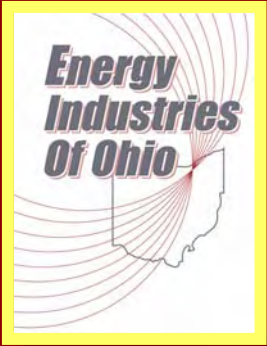
- ⇒ Performance Modeling by ORNL
 - ⇒ C.S. , CrMo , Selected Alloys
 - ⇒ Property Measurements (200-1200°F)
 - ⇒ Modeling
 - ⇒ Heat Transfer
 - ⇒ Stress
 - ⇒ Corrosion
 - ⇒ Thermal Fatigue



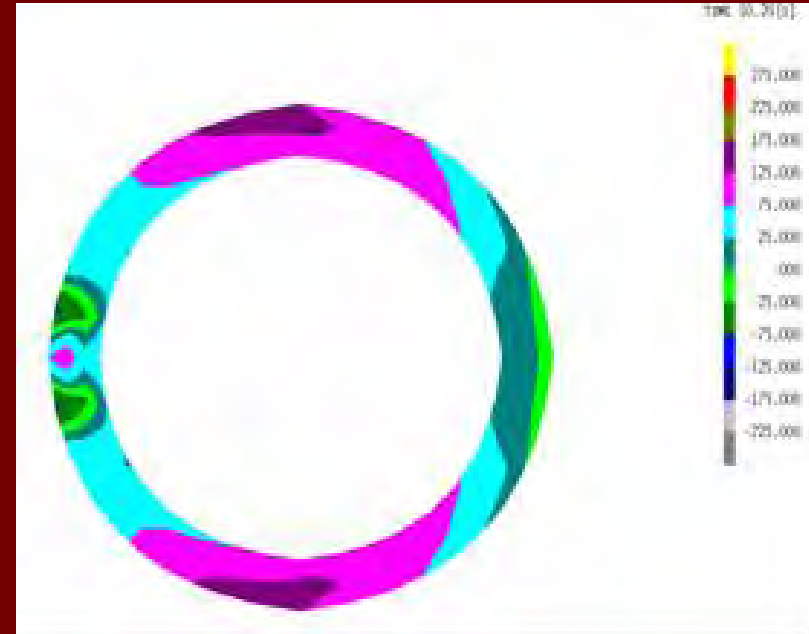
Modeling Results



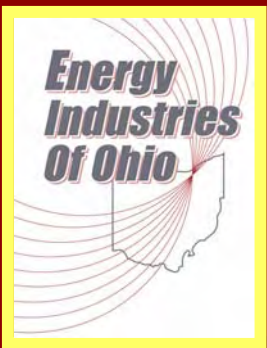
Heat Transfer Modeling



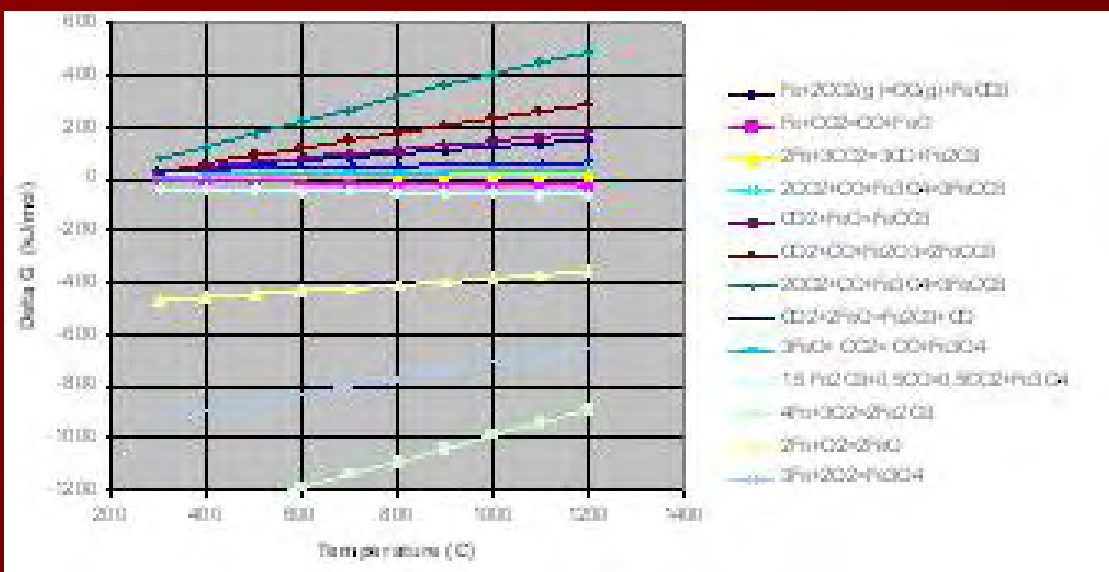
Modeling Results



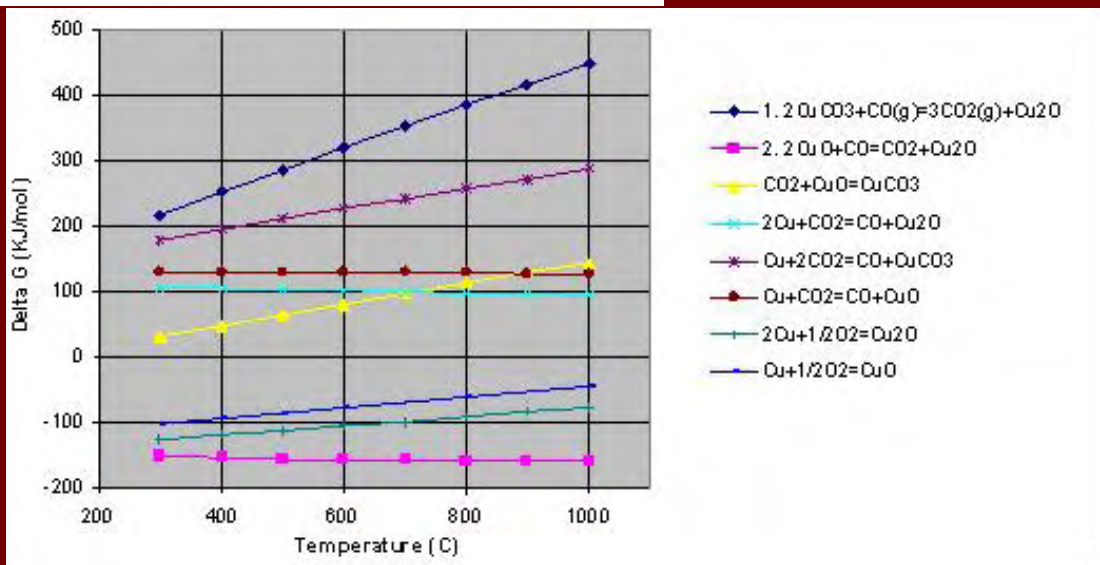
Thermo-Mechanical Stress Modeling

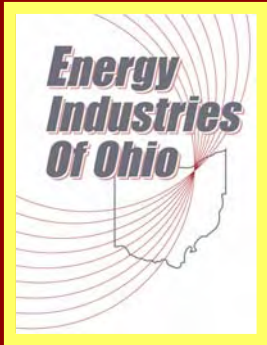


Modeling Results



Corrosion Modeling





Field Test Candidate Identified

⇒ Aluminum Bronze Alloy - AmeriBronze®

⇒ Composition Similar to C 61300 Series

~ 91%Cu, 6.5 Al, 2.5 Fe, 0.25 Sn

⇒ Property / Modeling Results Overview

⇒ Acceptable Mechanical Properties

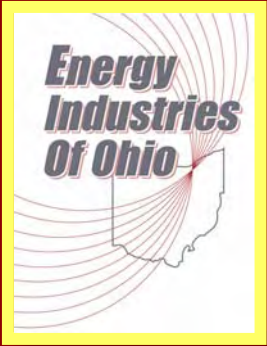
⇒ Better Heat Transfer – ~3 x C.S.

⇒ Corrosion Resistance – ~6 x C.S.

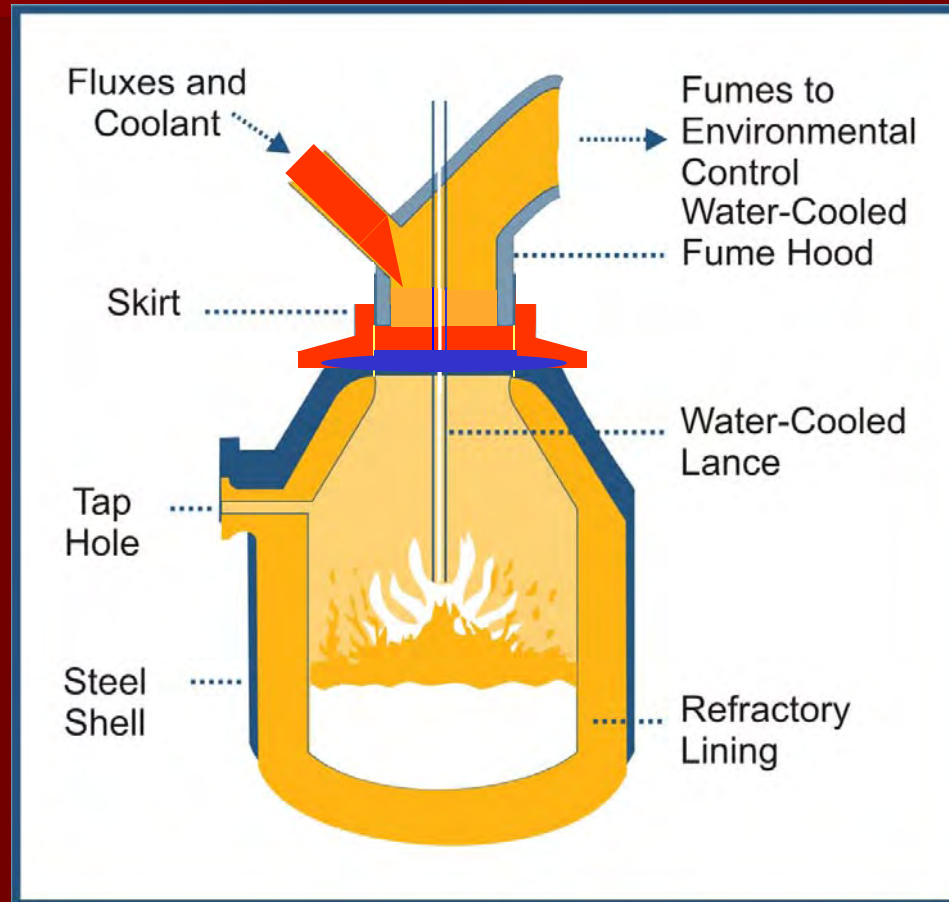
⇒ Lower Thermo-Mechanical Stress in Transient and Steady State Heat Transfer Regimes

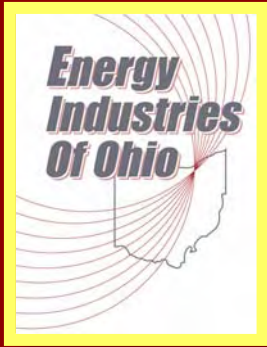
⇒ Better Thermal Fatigue Resistance Factor

$$(M = k (ys) (1 - \nu) / \alpha E)$$



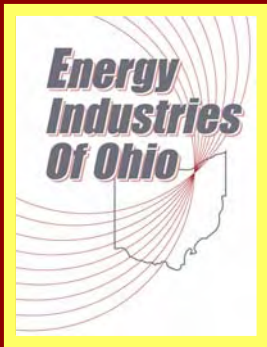
REP Equipment Schematic





REP Performance History Carbon Steel

- ⇒ Skirt
 - ⇒ ~ 20 Month Life
 - ⇒ ~ 80 Shutdowns for Repairs
- ⇒ Flux Chute
 - ⇒ ~ 12 Month Life
 - ⇒ ~ 20 Additional Repairs
- ⇒ REP was about to order a skirt
agreed to order AmeriBronze



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