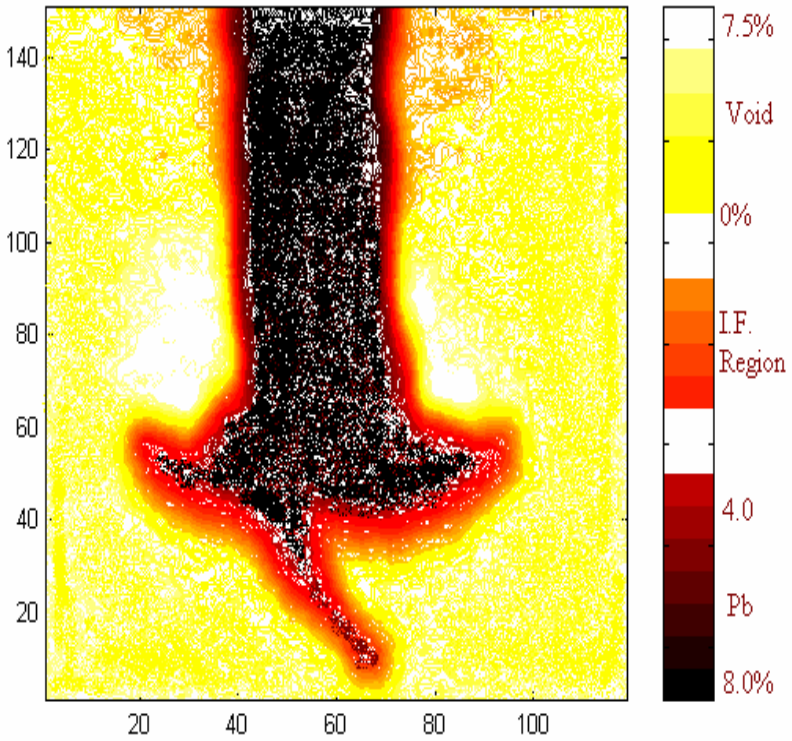
Idaho National Engineering and Environmental Laboratory

Corrosion Studies in Support of FBR Deployment

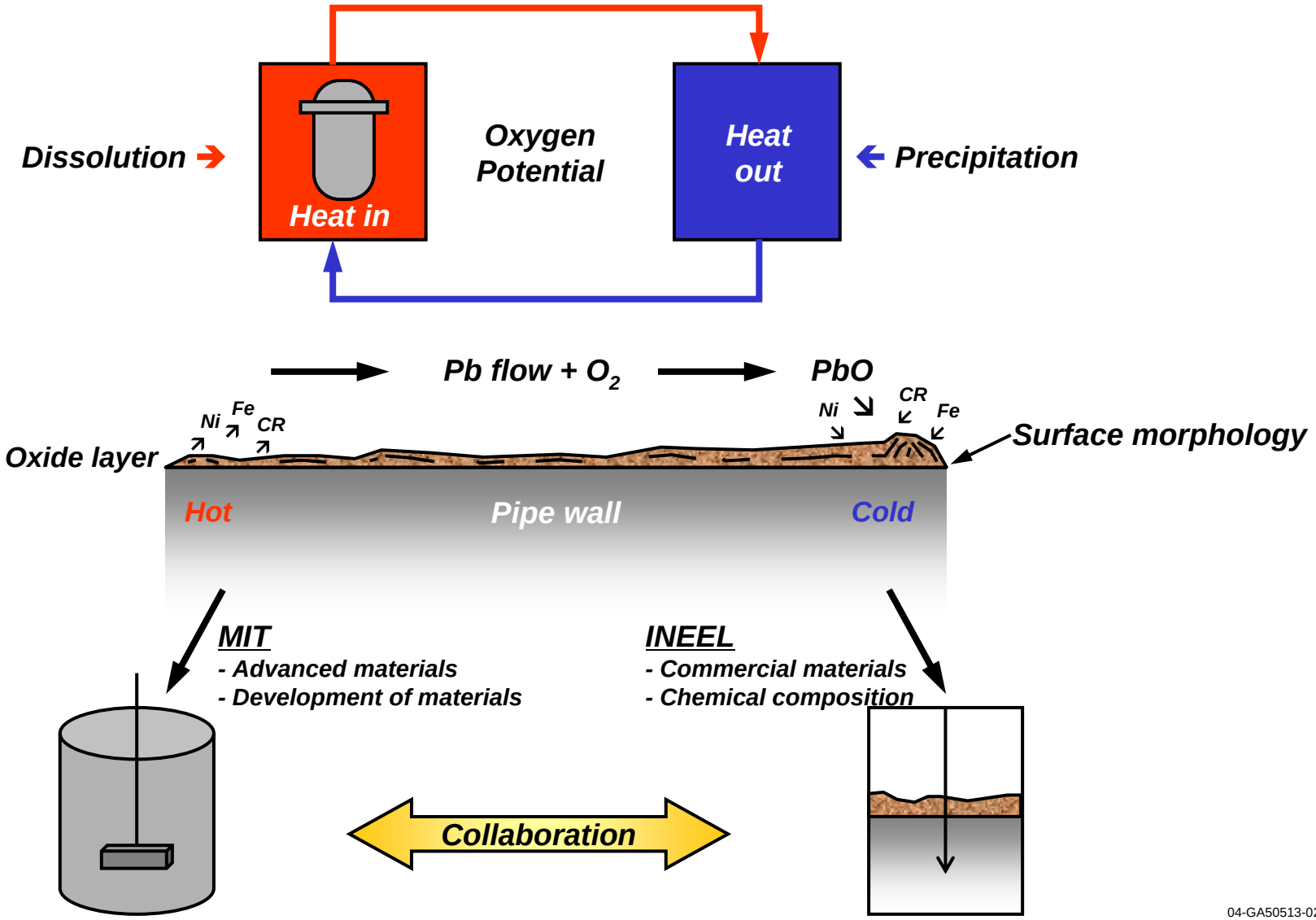
Dr. Eric Loewen
Loewep@inel.gov

Presentation at
1st COE-INES

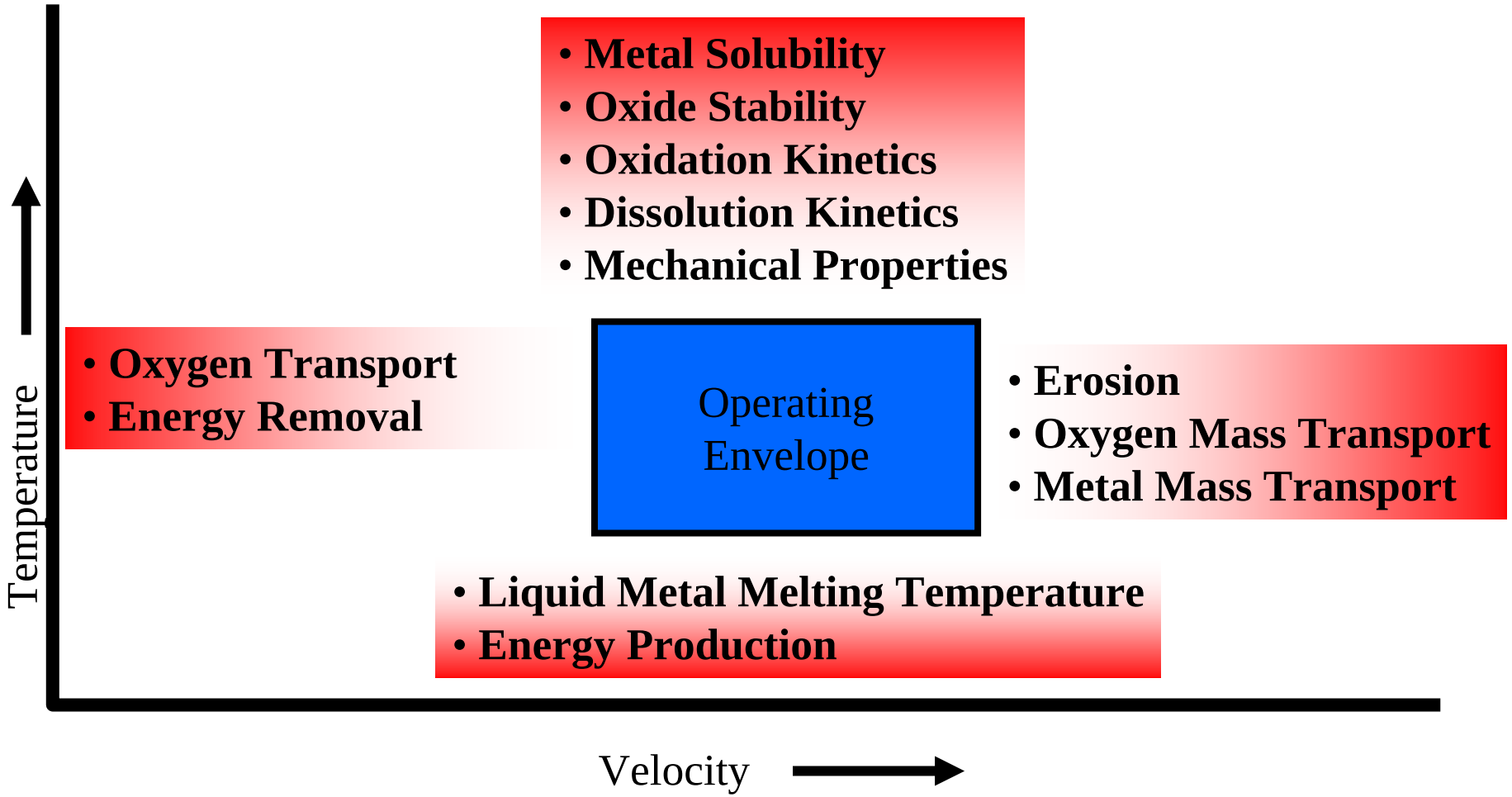
November 2004



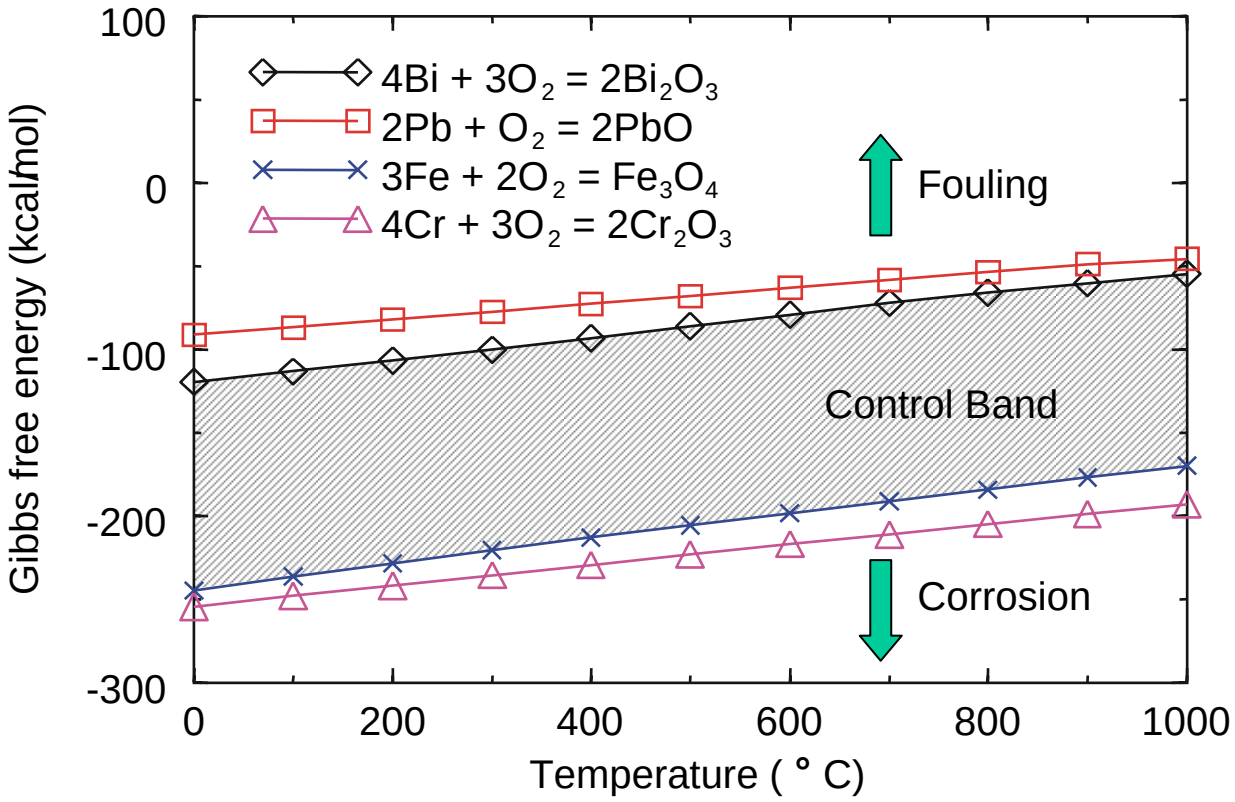
Mass Transfer Corrosion



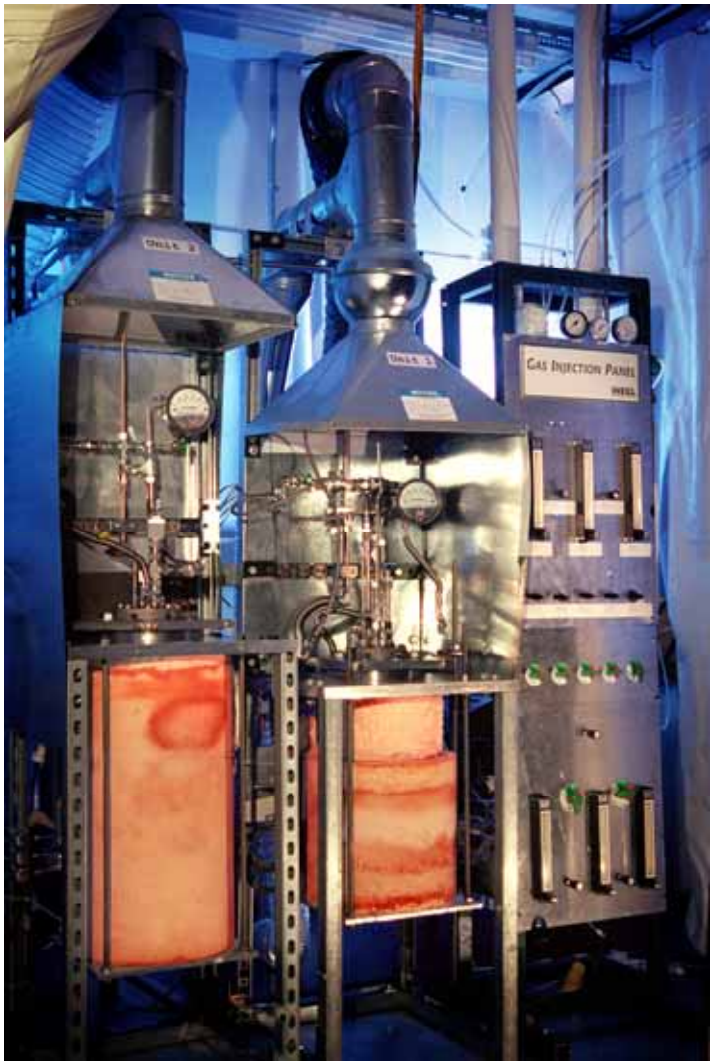
Key Limits *(MIT R. Ballinger)*



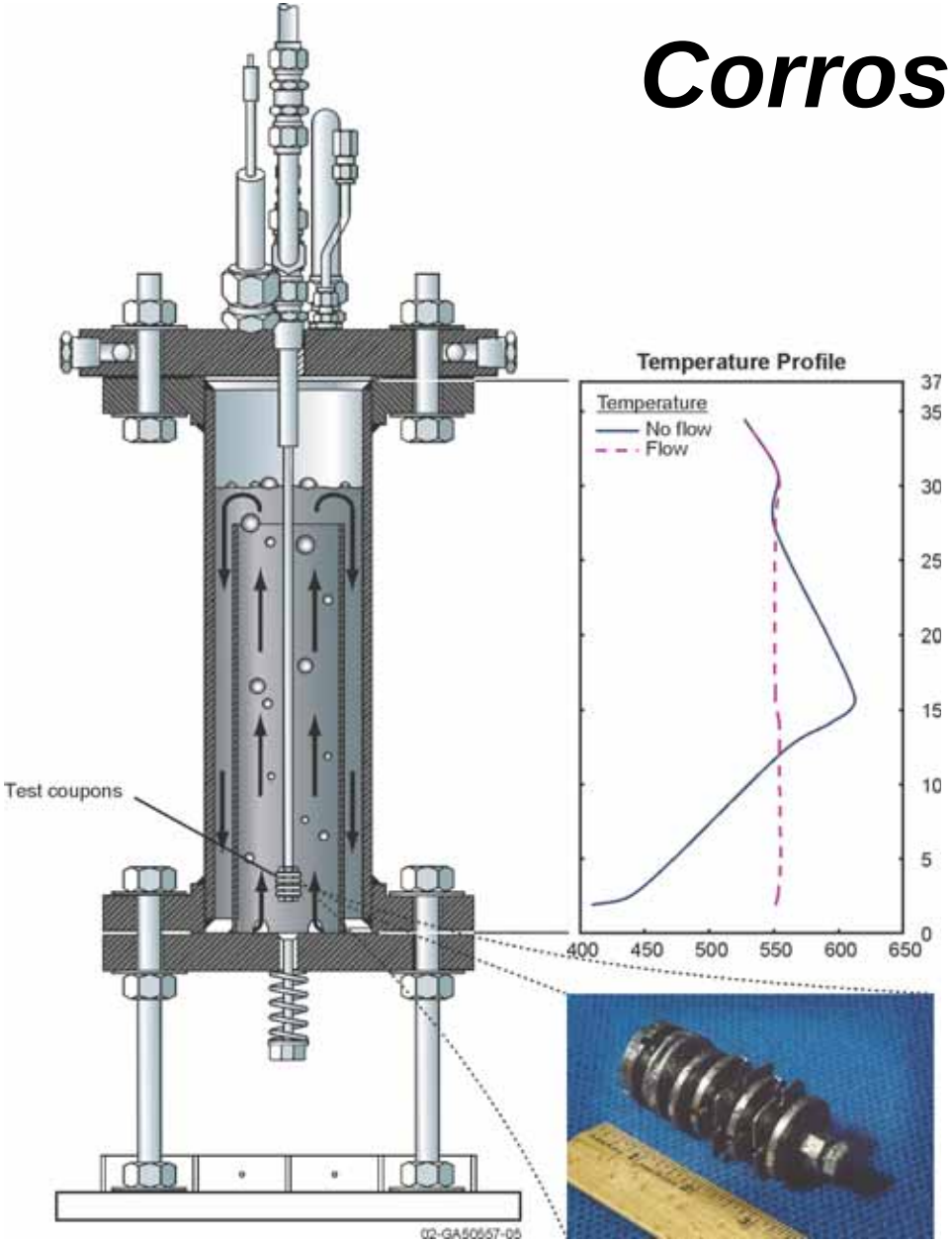
Corrosion Control Requires O_2 Control



Facilities at the INEEL



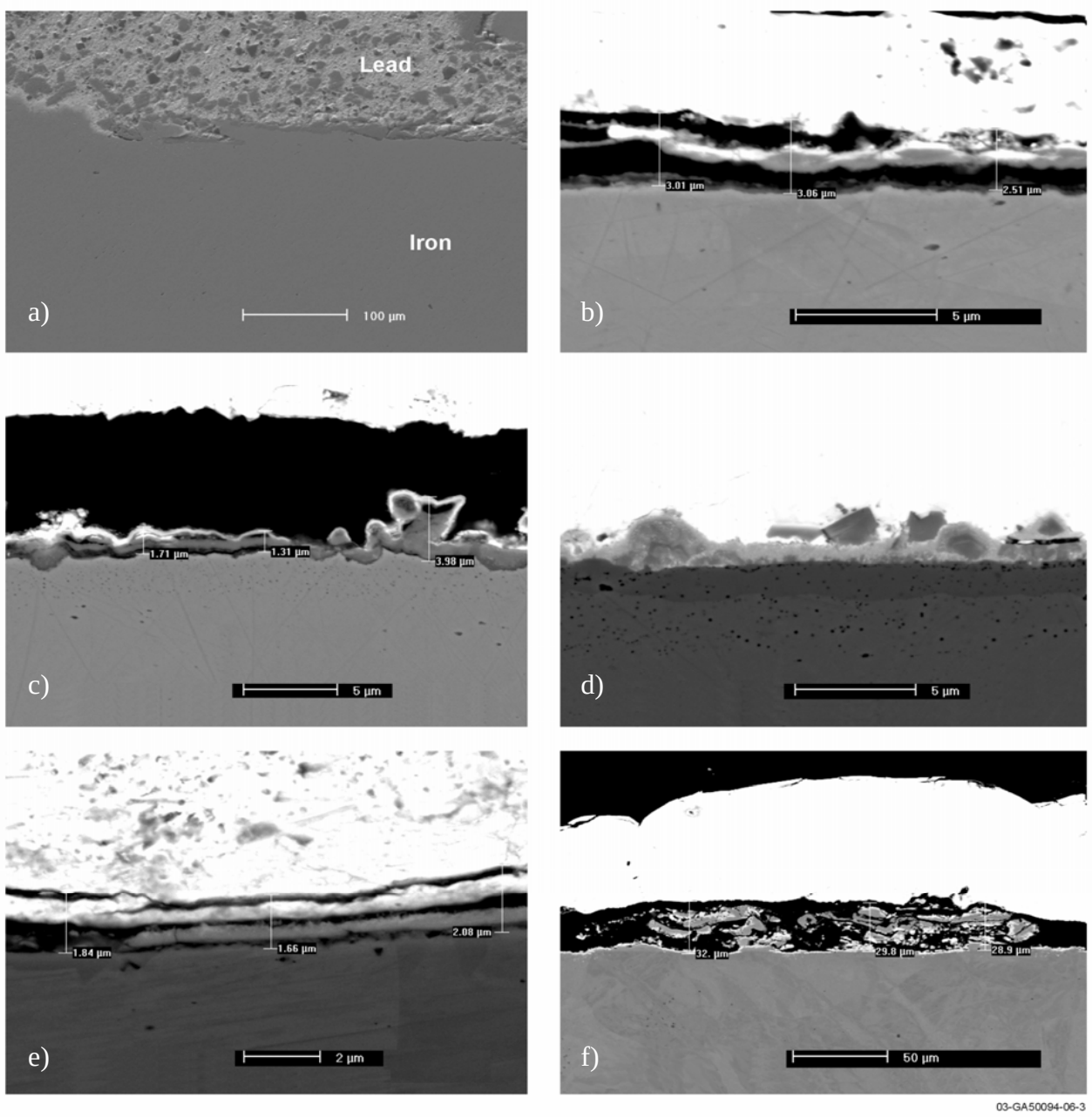
Corrosion Cell Internals



- *Experiments operated to 700 °C (can go higher)*
- *Over 7,000 hours of experimental run time*
- *Cell materials used: 316, 410, carbon steel and Zr-Hf alloy*
- *Gas assisted flow, creating isothermal conditions*
- *Large sample volume*

Experiments 12 and 13

- *Carbon control of O_2*
- *Temperature*
  - *Exp 12 – 650 °C*
  - *Exp 13 – 700 °C*
- *Sampling times*
  - *100, 300, 700, 1000 hours*
- *Melt: LBE*
- *Cell: 410 Stainless Steel*



Pure Fe Samples

a) *MIT 600 °C for 1000 hrs*

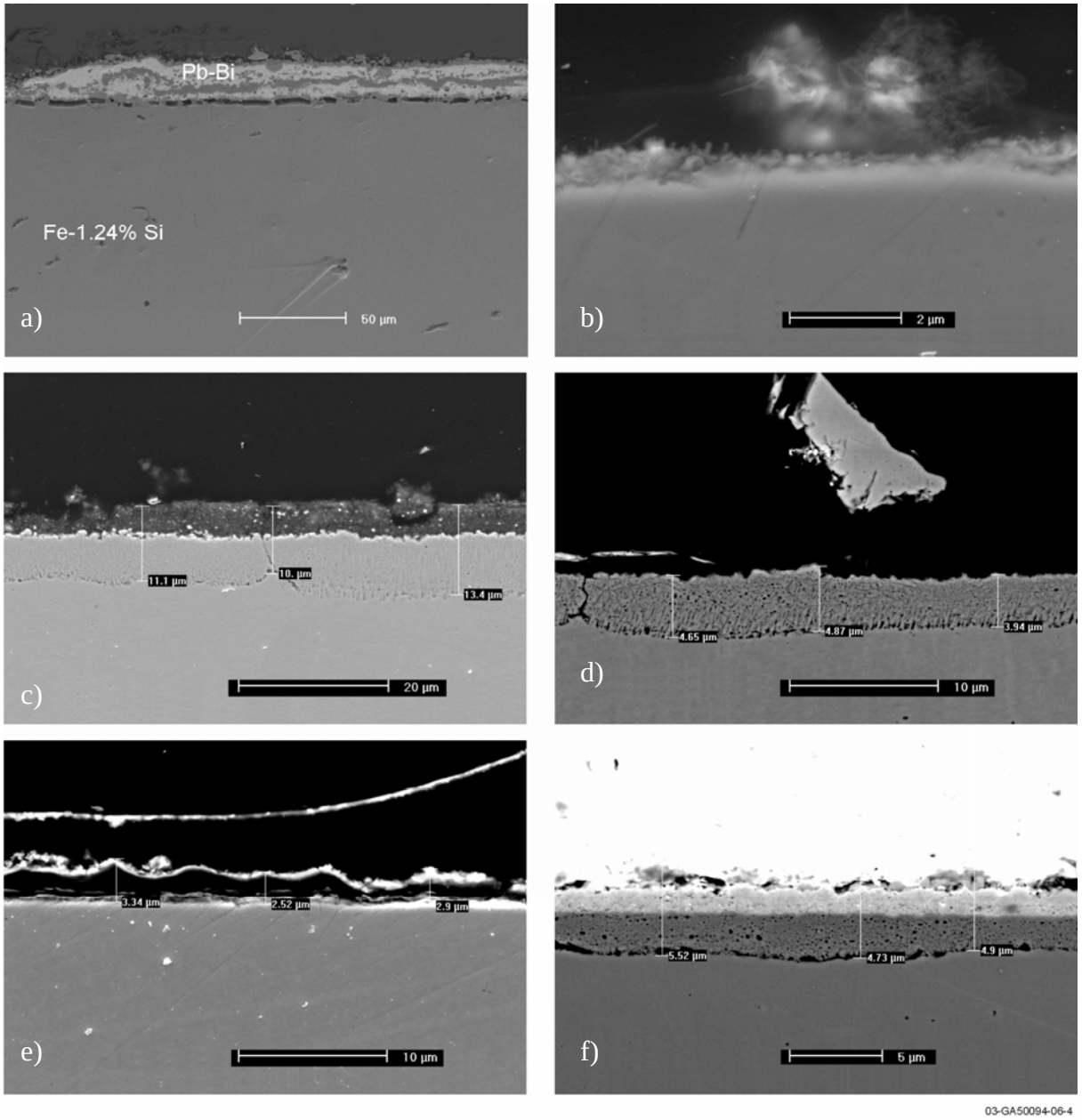
b) *INEEL 650 °C for 100 hrs*

c) *INEEL 650 °C for 300 hrs*

d) *INEEL 650 °C for 1000 hrs*

e) *INEEL 700 °C for 100 hrs*

f) *INEEL*



Fe-1.24% Si Samples

a) MIT 600 °C for 100 hrs

b) INEEL 650 °C for 100 hrs

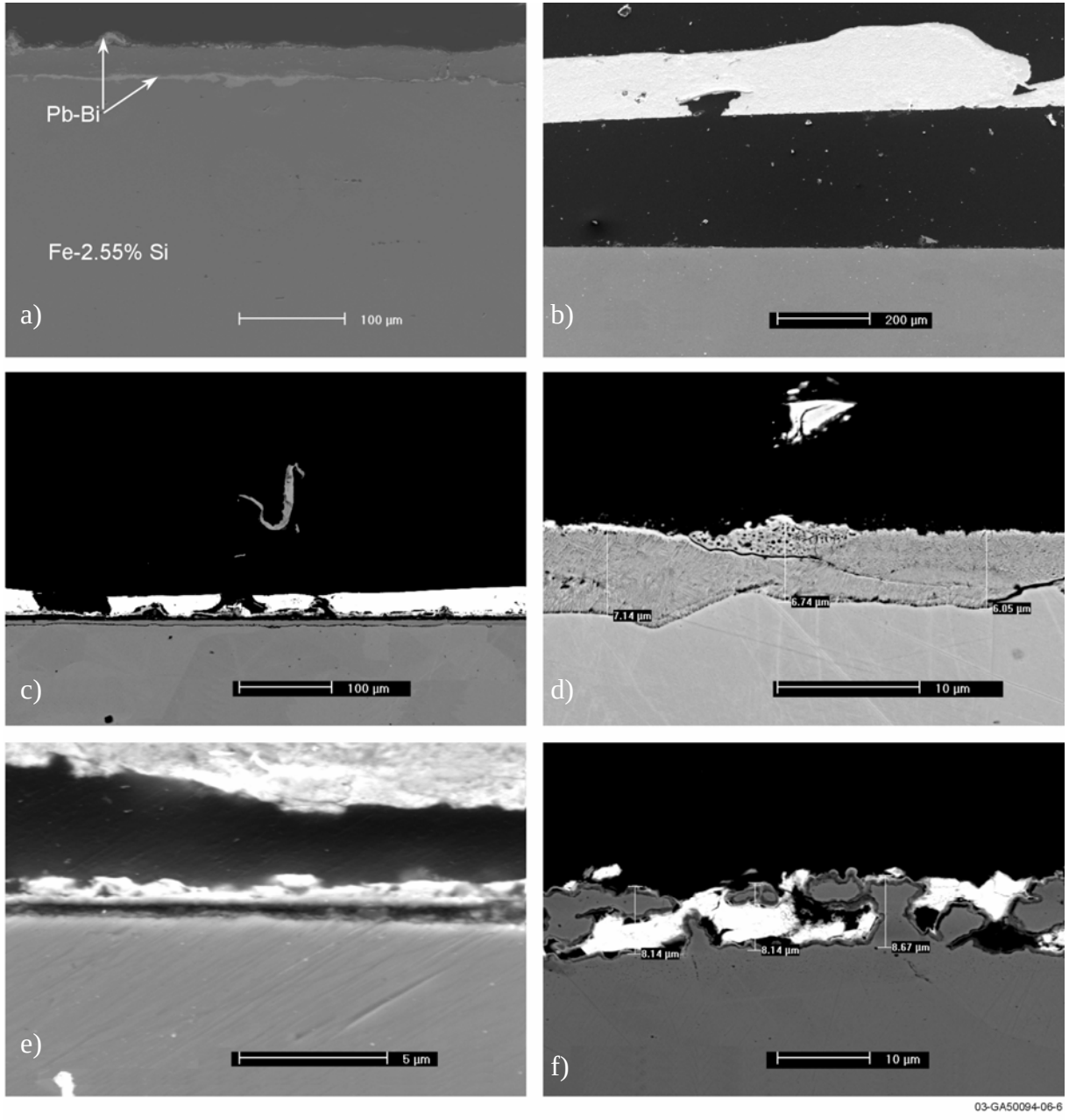
c) INEEL 650 °C for 100 hrs

d) INEEL 650 °C for 1000 hrs

e) INEEL 700 °C for 100 hrs

f) INEEL 700 °C for 750 hrs

410 corrosion cell



Fe-2.55% Si Samples

a) MIT 600 °C for 100 hrs

b) INEEL 650 °C for 100 hrs

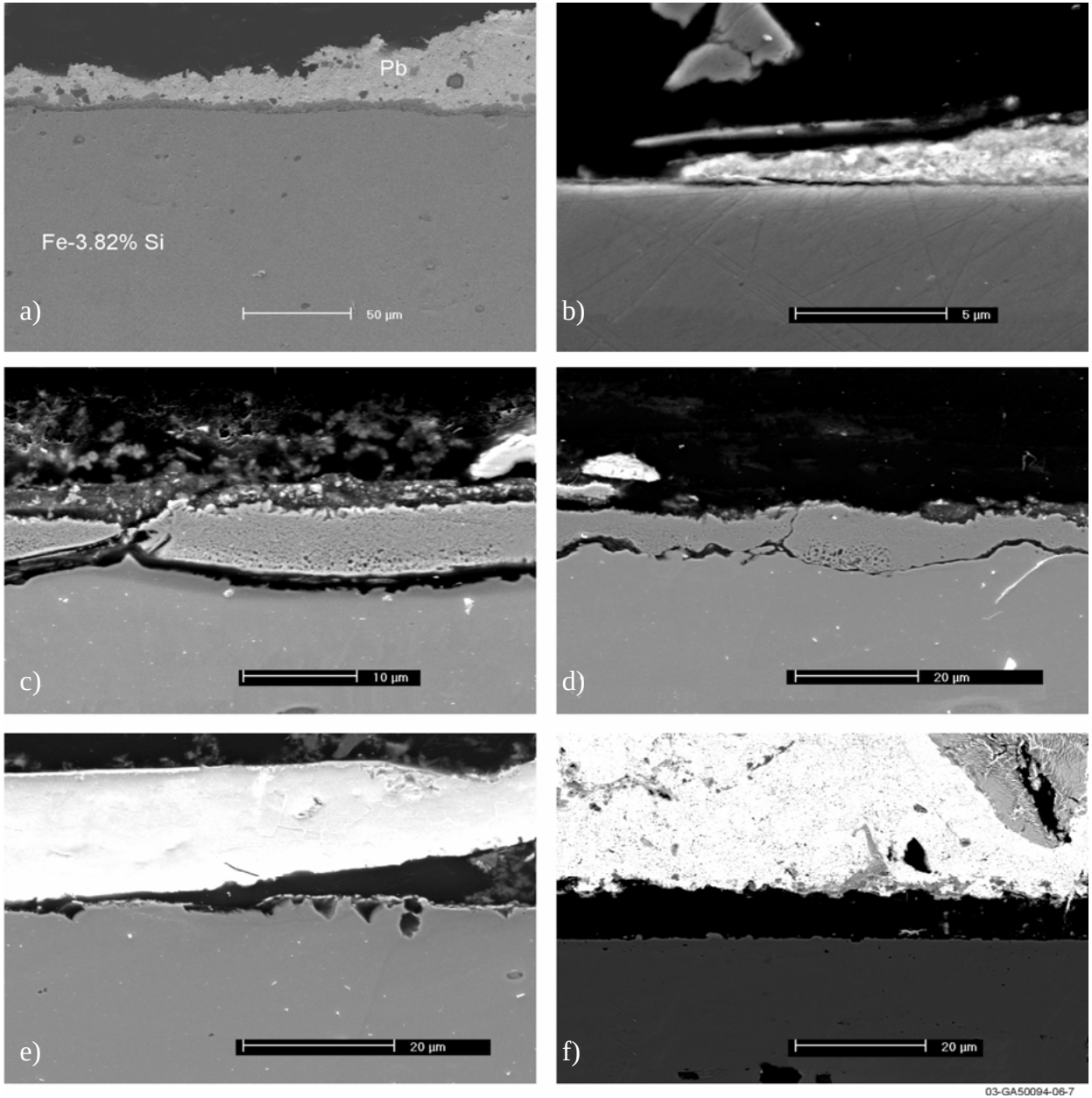
c) INEEL 650 °C for 300 hrs

d) INEEL 650 °C for 100 hrs

e) INEEL 700 °C for 100 hrs

f) INEEL 650 °C for 300 hrs

410 corrosion cell



Fe-3.82% Si Samples

a) MIT 600 °C for 100 hrs

b) INEEL 650 °C for 100 hrs

c) INEEL 650 °C for 300 hrs

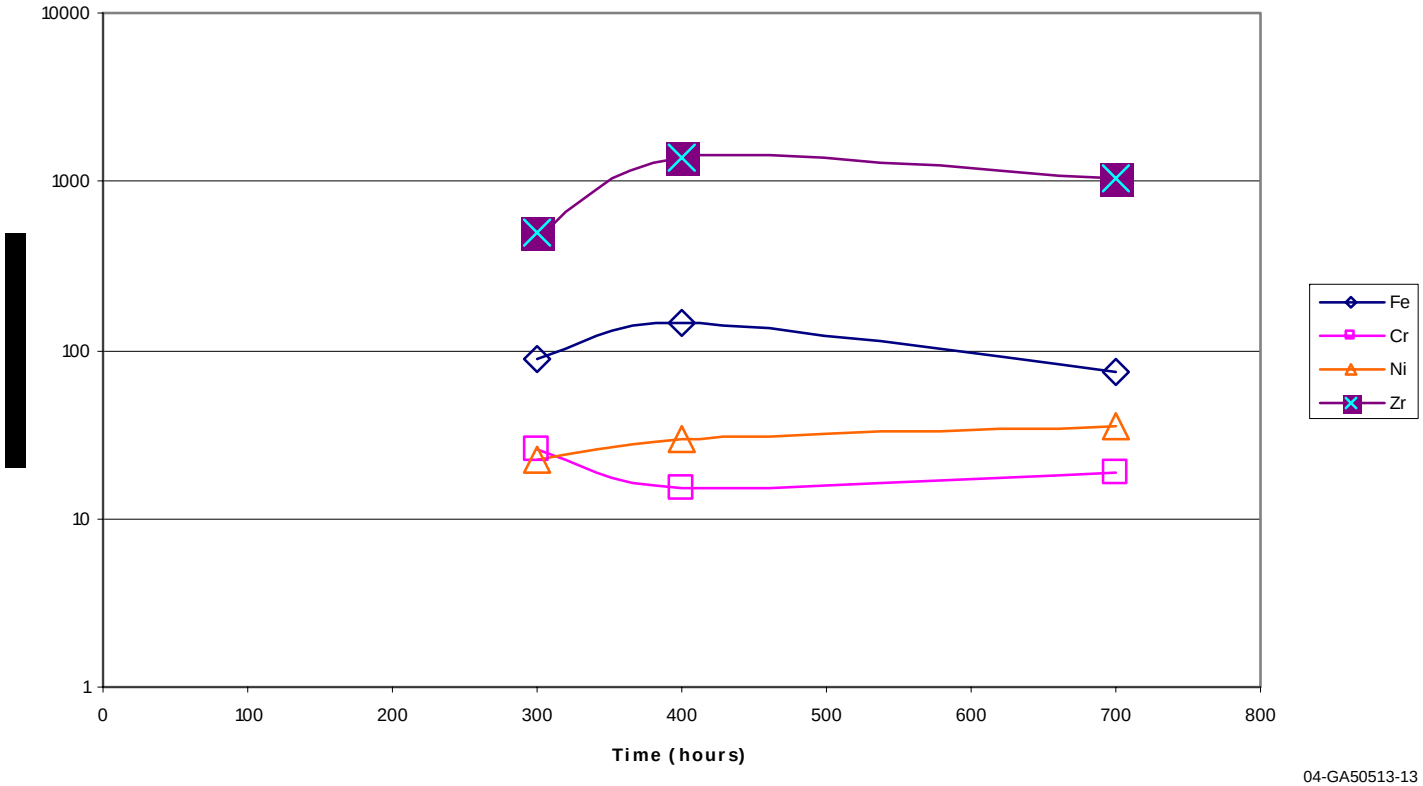
d) INEEL 650 °C for 1000 hrs

e) INEEL 700 °C for 100 hrs

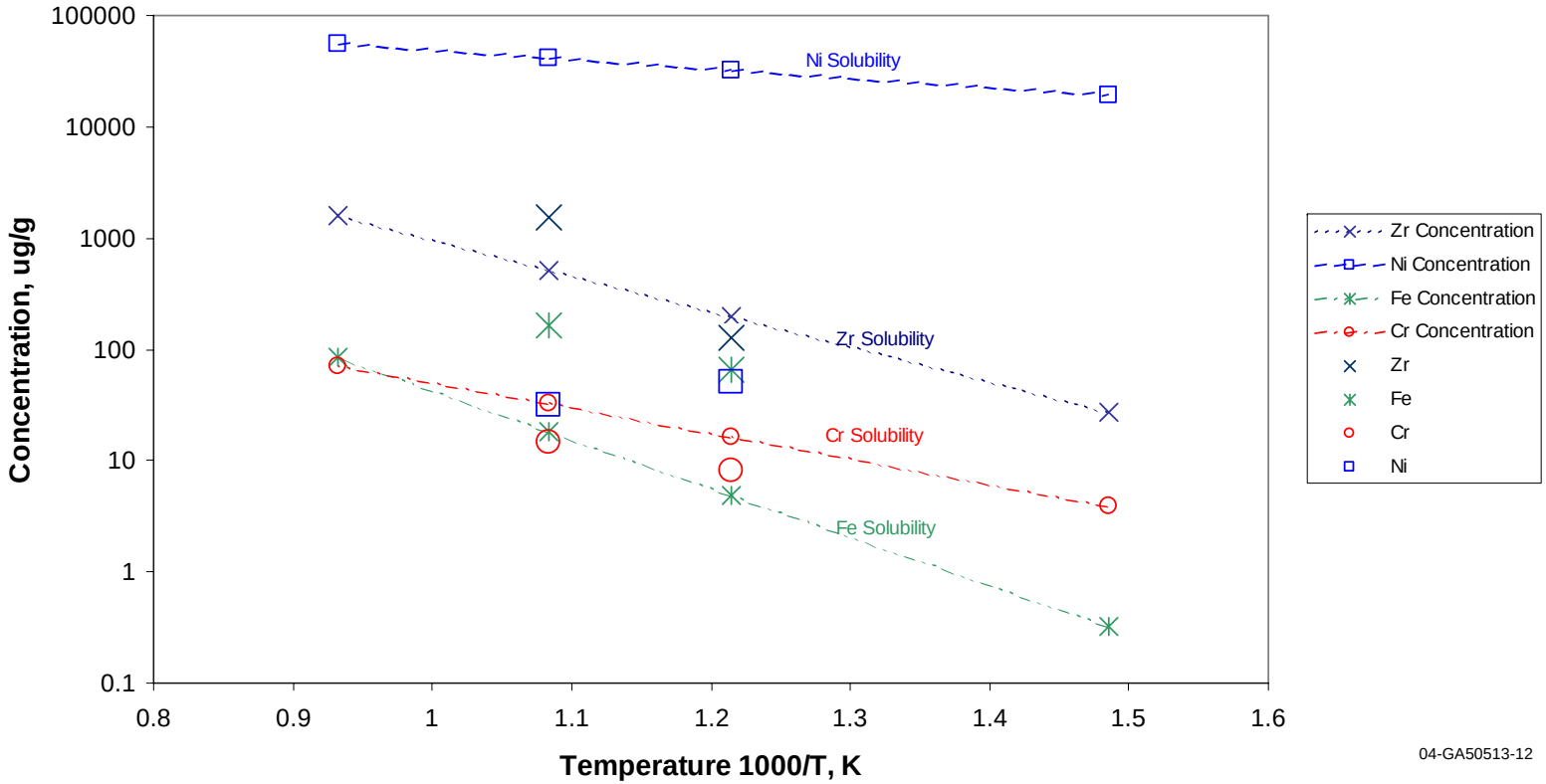
f) INEEL 700 °C for 600 hrs

410 corrosion cell

INEEL ICP Data: Exp 13 (410 SS, 700 °C)



ICP Comparison Data Exp 12 and 13 (410 SS)



Conclusion

- *Corrosion tests of several classes of metals revealed the difference in corrosion resistance*
- *Corrosion testing not only dependent on surface conditions, material, temperature, and oxygen potential but corrosion cell.*
- *Refractory metals exhibit the least degradation but use as major structural component limited.*
- *Fundamental understanding of Fe-Si-Cr system is being developed.*