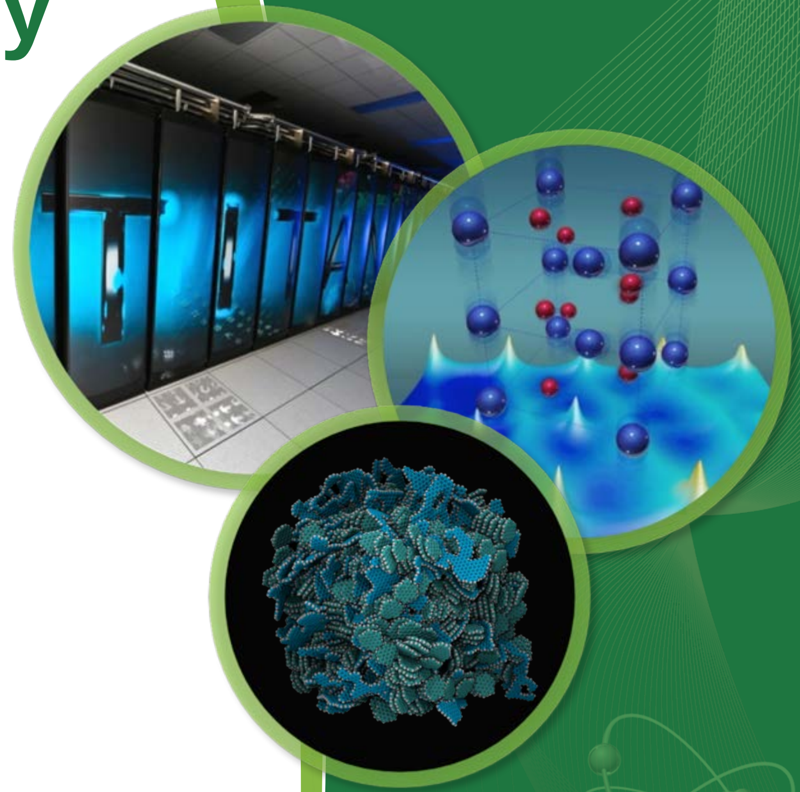
sCO_2 Panel Input from Oak Ridge National Laboratory



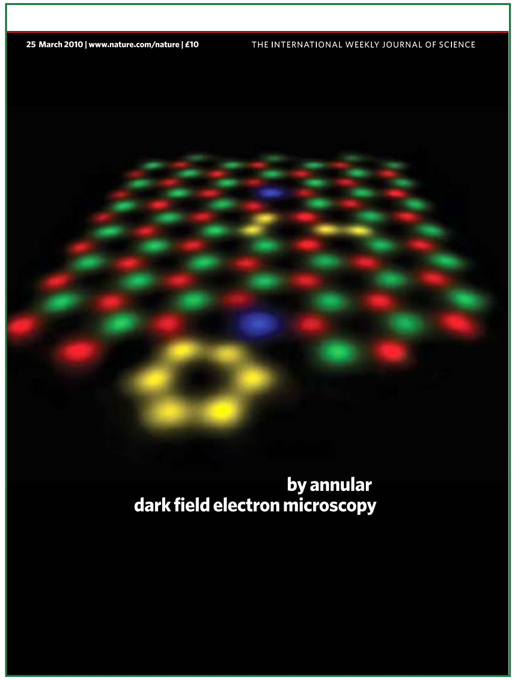
B. A. Pint

Corrosion Science & Technology Group
Materials Science & Technology Division

OAK RIDGE National Laboratory

ORNL's Materials Science and Technology Division Spans Basic to Applied Research

- ~$100 M Budget
- ~230 staff + ~60 postdocs
- 20 research groups
- basic to applied research in structural *and* functional materials
- noted for technology development and transfer
  - 73 R&D 100 Awards
  - ~60 invention disclosures/year
  - ~30 patents filed/issued/year



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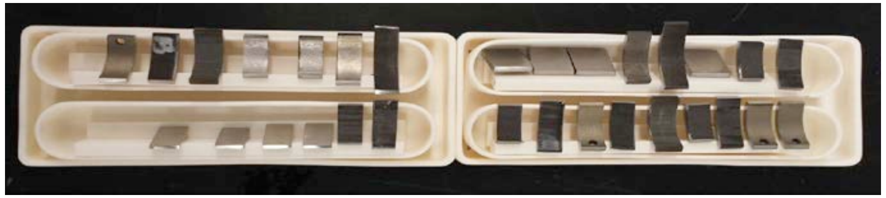
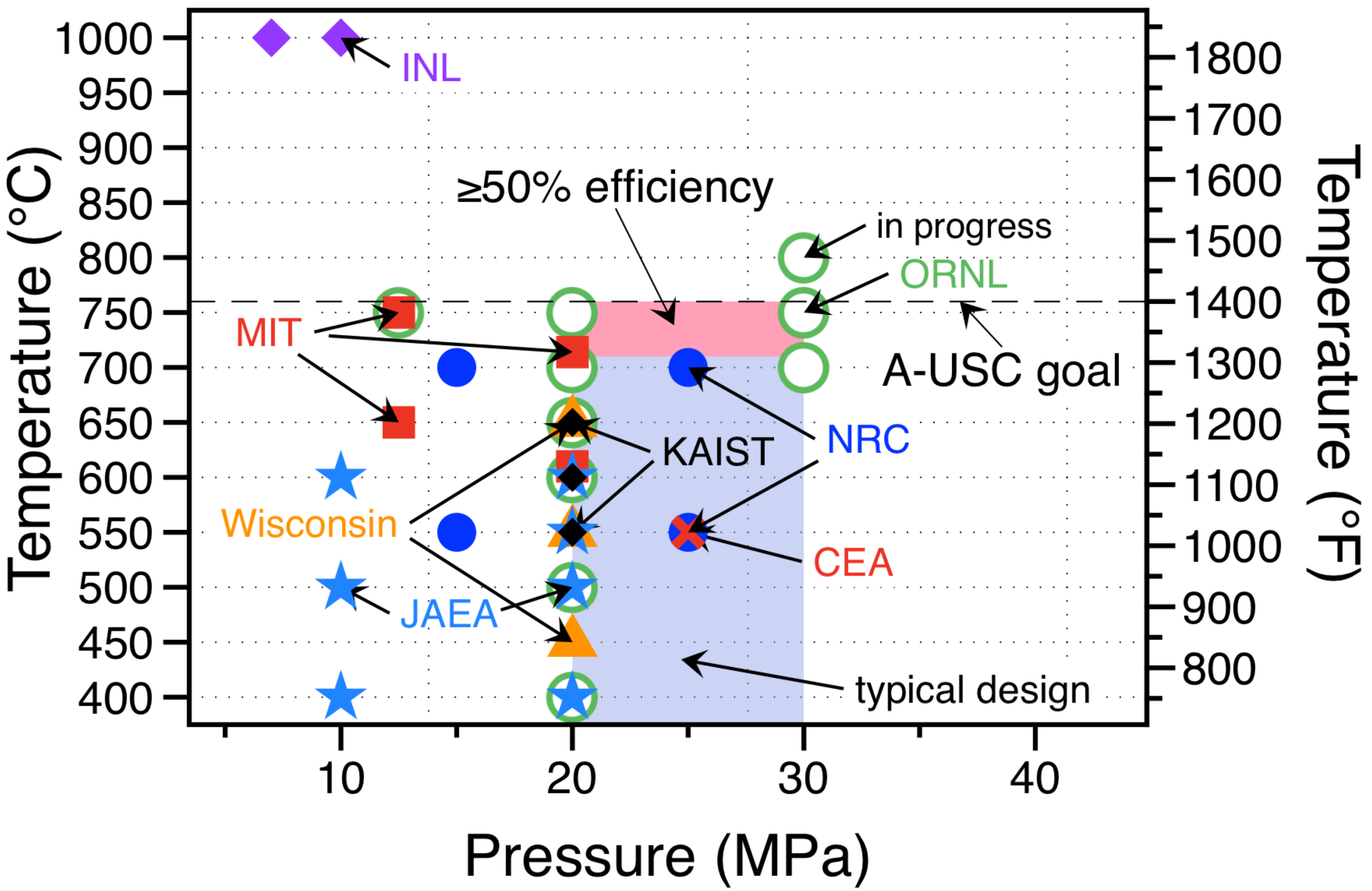
ORNL has several capabilities for studying CO_2 corrosion

1. Automated Cyclic Rigs (1 bar)
2. 3-zone tube furnaces (1 bar)
3. 282 autoclave (300 bar)

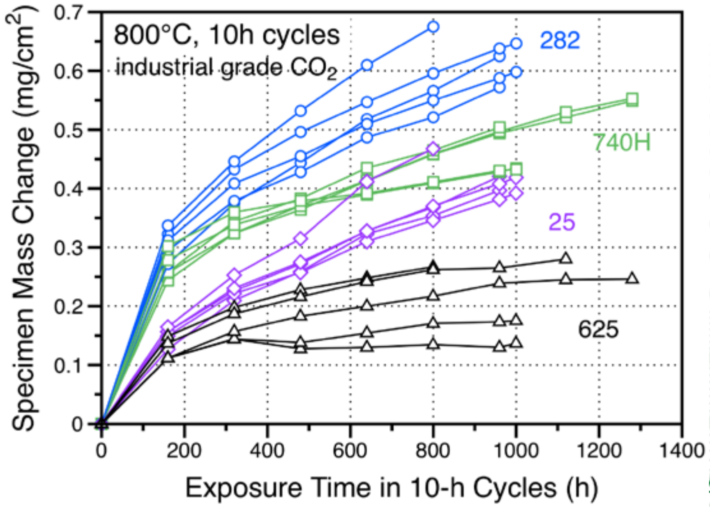


New temperature-pressure capabilities in new autoclave



What now?

- Larger autoclave (more specimens at ±3°C)
- Controlled impurities (H_2O + O_2) at 300 bar
  - On-line detector system for H_2O and O_2 in sCO_2 at 300 bar
  - Operate system in FY17
- SunShot (CSP) Lifetime modeling project (FY16-FY18)
  - Long-term exposures:
  - 1 bar CO_2, 10-h cycles, 700°-800°C
  - 1 bar CO_2, 500-h cycles, 750°C
  - 300 bar CO_2, 500-h cycles, 700°-800°C



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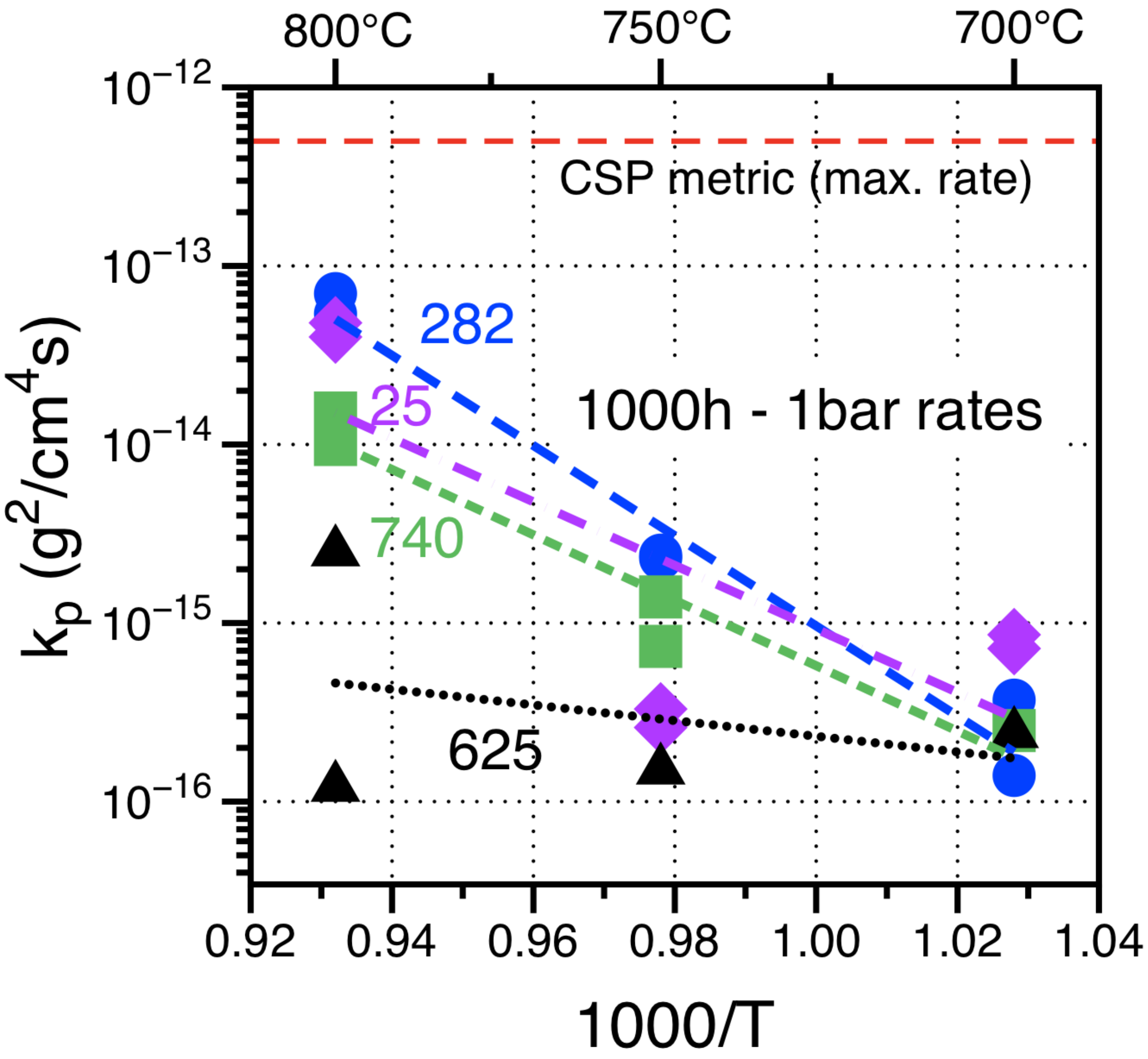
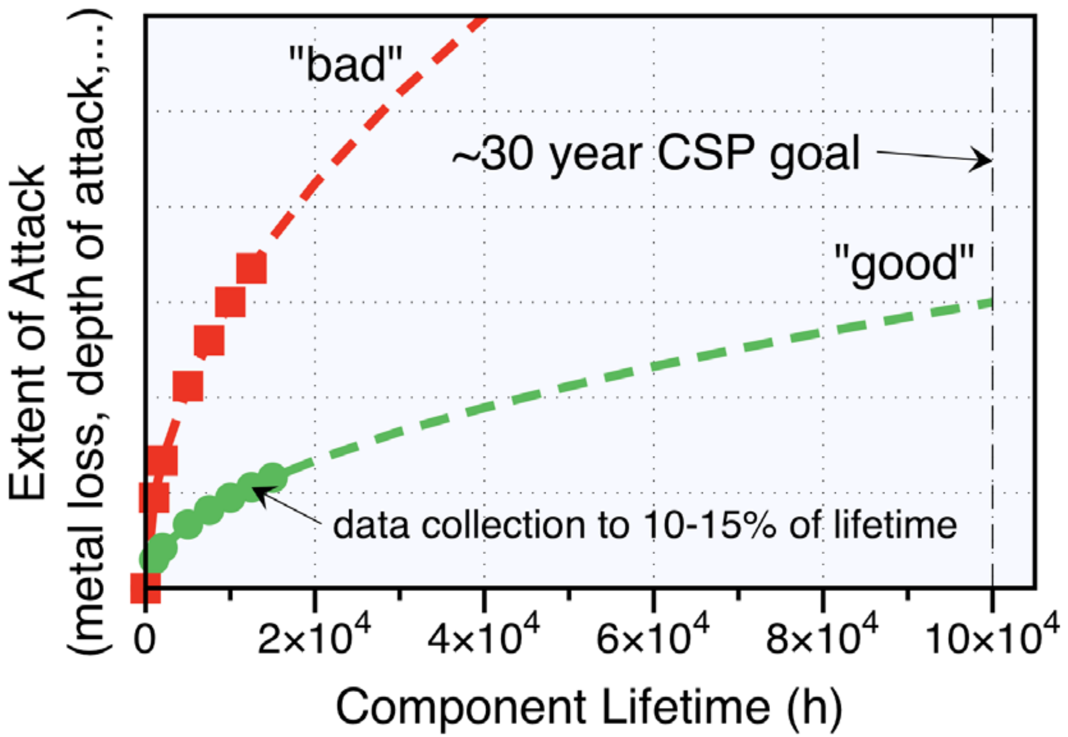
SunShot project has metrics to meet 30 year (100 kh) life





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Key questions

- Does lower C solubility in Ni-base alloys make them “immune”?
- Limitation of Fe-base alloys (e.g. C-steel, low-Cr steel, 18-8 SS)
  - Does carburization restrict temperature? Fear of breakaway?
- Corrosion allowance for thin-walled components?
  - Oxide thickness may not be extent of damage
- Mechanical properties of thin-walled components (creep debit?)
- Is erosion the real problem?
  - Fluid or debris? Is exfoliation of reaction product an issue?
- How do these more complex issues get addressed?
  - “cross-cut” appears to be lacking coordination on a technical level