eXtremeMAT

Accelerating the Development of Extreme Environment Materials

U.S. DEPARTMENT OF ENERGY

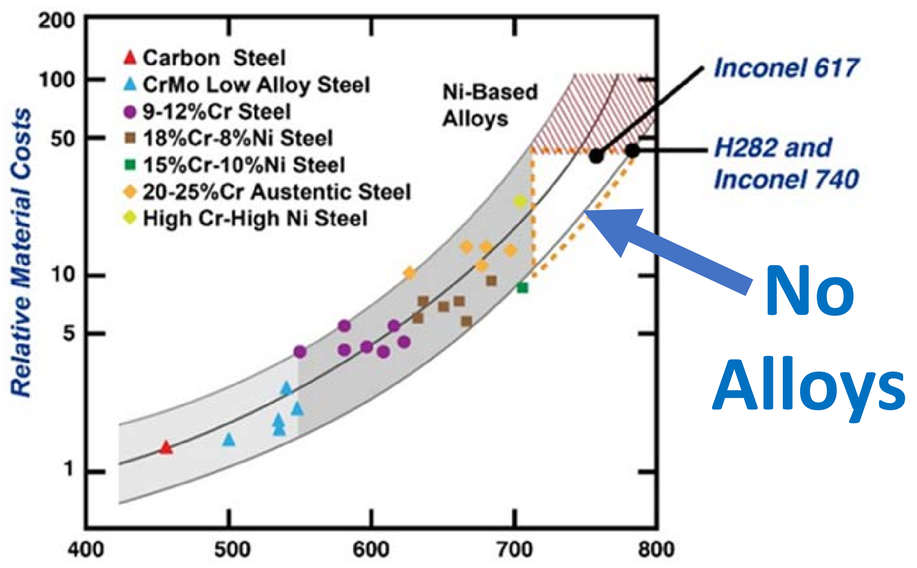
***The* US DOE-FE/NETL eXtremeMAT** *consortium leverages the unparalleled materials science expertise and capabilities resident within the Department of Energy's National Laboratory complex to accelerate the development of affordable and durable materials for extreme environment service.*

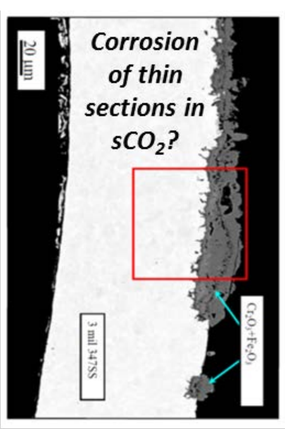
Importance

Life prediction for critical components in plants undergoing cycling conditions (e.g., hold-time fatigue)

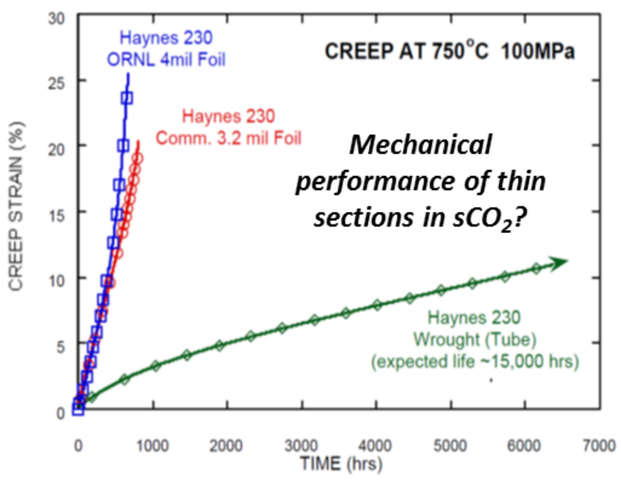
Lower cost, higher temperature austenitic alloys – reduce the cost of A-USC power cycles

Performance of thin sheet used in recuperators for sCO_2 power cycles





P.J. Masiasz, et al ORNL 2006



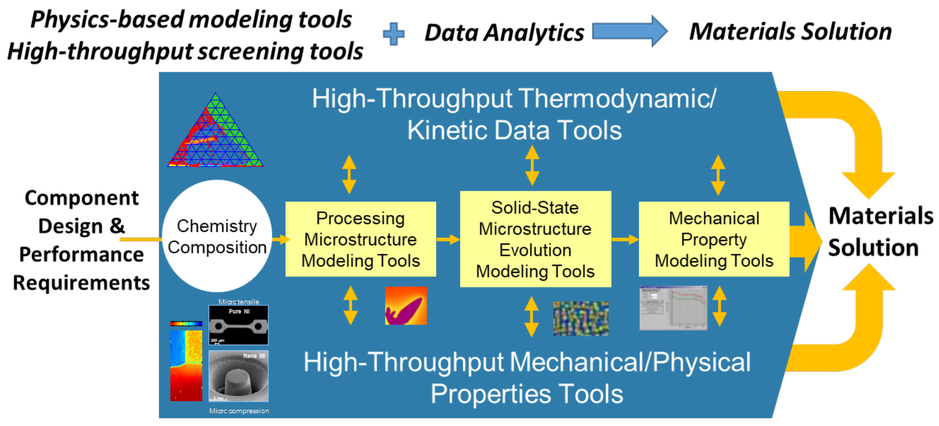
- Lower cost alloys for >650°C service
- *Thin section* long-term integrity

✓ Critical for advanced cycles (e.g., sCO_2 power cycles), but also valuable for existing FE power plants

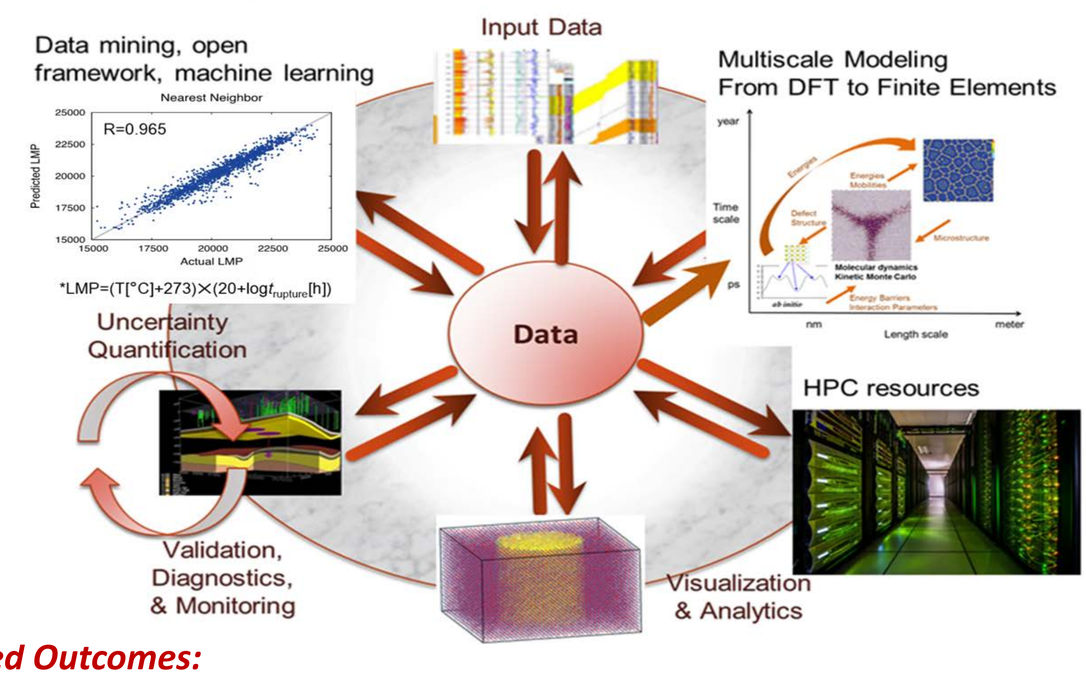
Opportunity

Utilize *world leading NL* resources in a focused and coordinated effort.

- ★ *Materials design*
- ★ *High Performance Computing power*
- ★ *Advanced processing & manufacturing*
- ★ *In-situ characterization*
- ★ *Performance assessment at condition*



eXtremeMAT:* *Physics based models coupled with data analytics and machine learning



Anticipated Outcomes:

Tool sets that address the gaps in current physics-based materials modeling, data analytics and machine learning to enable:

- ★ *Reliable prediction of materials performance over long service lifetimes in FE power plant environments*
- ★ *Improved alloy design capability to increase high temperature capability of austenitic steels and alloys, accelerated development of new alloys.*

https://edx.netl.doe.gov/eXtremeMAT

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