



Environmental Effects

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Changing the World's Energy Future

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U.S. DEPARTMENT OF
ENERGY

Office of
NUCLEAR ENERGY

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AMMT/ART Materials Program Review Meeting, May 21-23, 2024, Lemont, IL

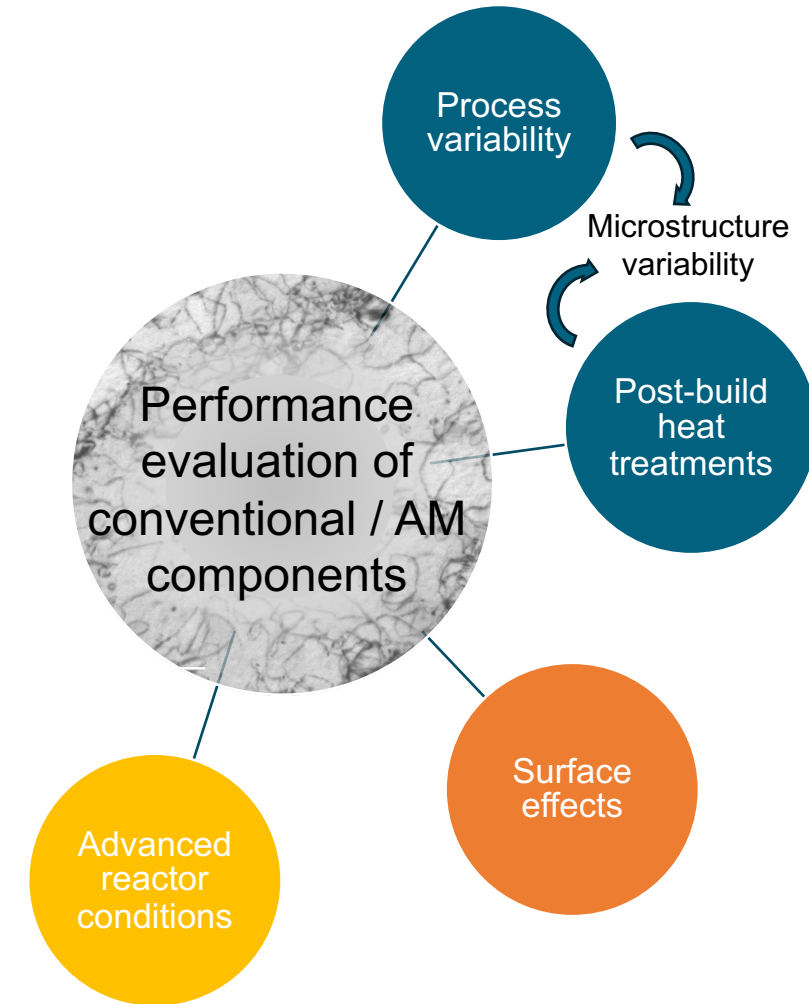
What is the Environmental Effects technical area?

- **Material evolution and lifetime in harsh advanced reactor environments must be part of a reactor material development and qualification program**
- **Evaluating in-reactor performance of new materials is one of the most critical technical hurdles for their rapid adoption in nuclear energy systems**
 - The effect of process and microstructure variability must be assessed
- **The Environmental Effects technical area covers materials degradation for topics of concern to the NRC that are not covered by ASME, including corrosion and irradiation effects on mechanical properties**
- **The Environmental Effects technical area has four broad goals:**
 - First-of-a-kind degradation data on new materials and components
 - Effect of microstructure variability on degradation
 - Getting to the answer faster (faster tests, less tests...) for rapid and effective qualification on materials performance and degradation in reactor environments
 - Establishing a technical basis for regulatory acceptance by providing needed data and models to support reactor design and operation

Example: Corrosion rate

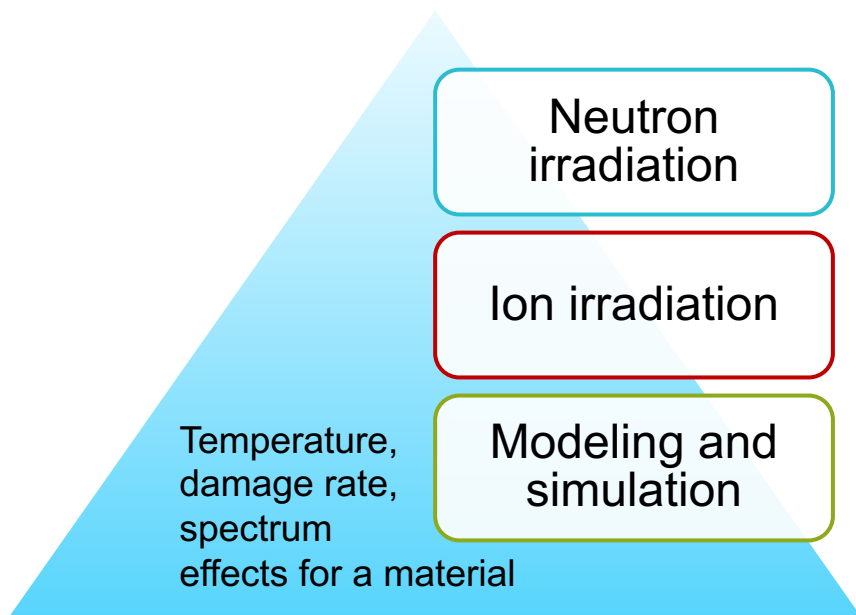
4.6 ± 0.7

μm/year

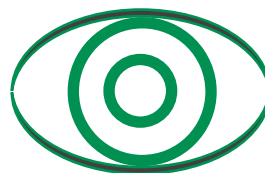


Environmental effects are reactor-specific...

...But there are ways to be cross-cutting



Computer vision



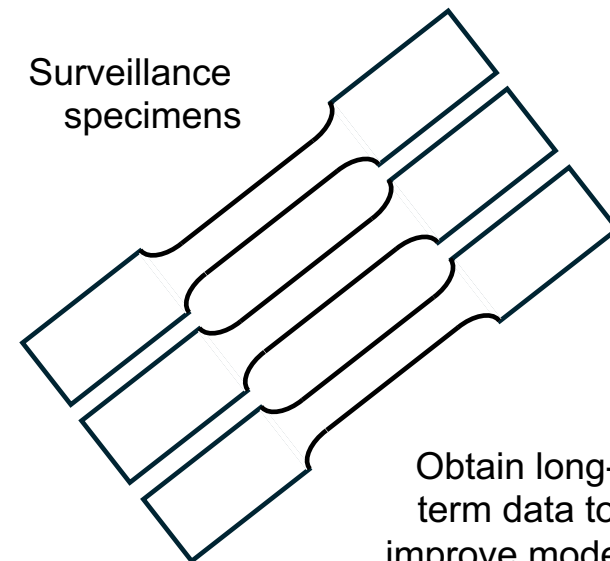
Rapidly gather quantitative data sets

Corrosion testing



Consider the same material in different environments

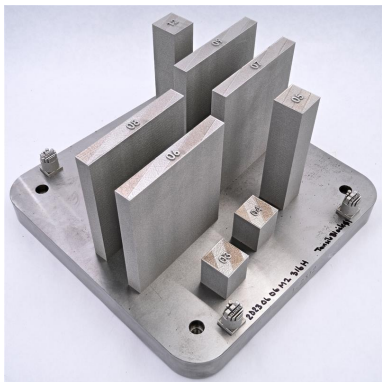
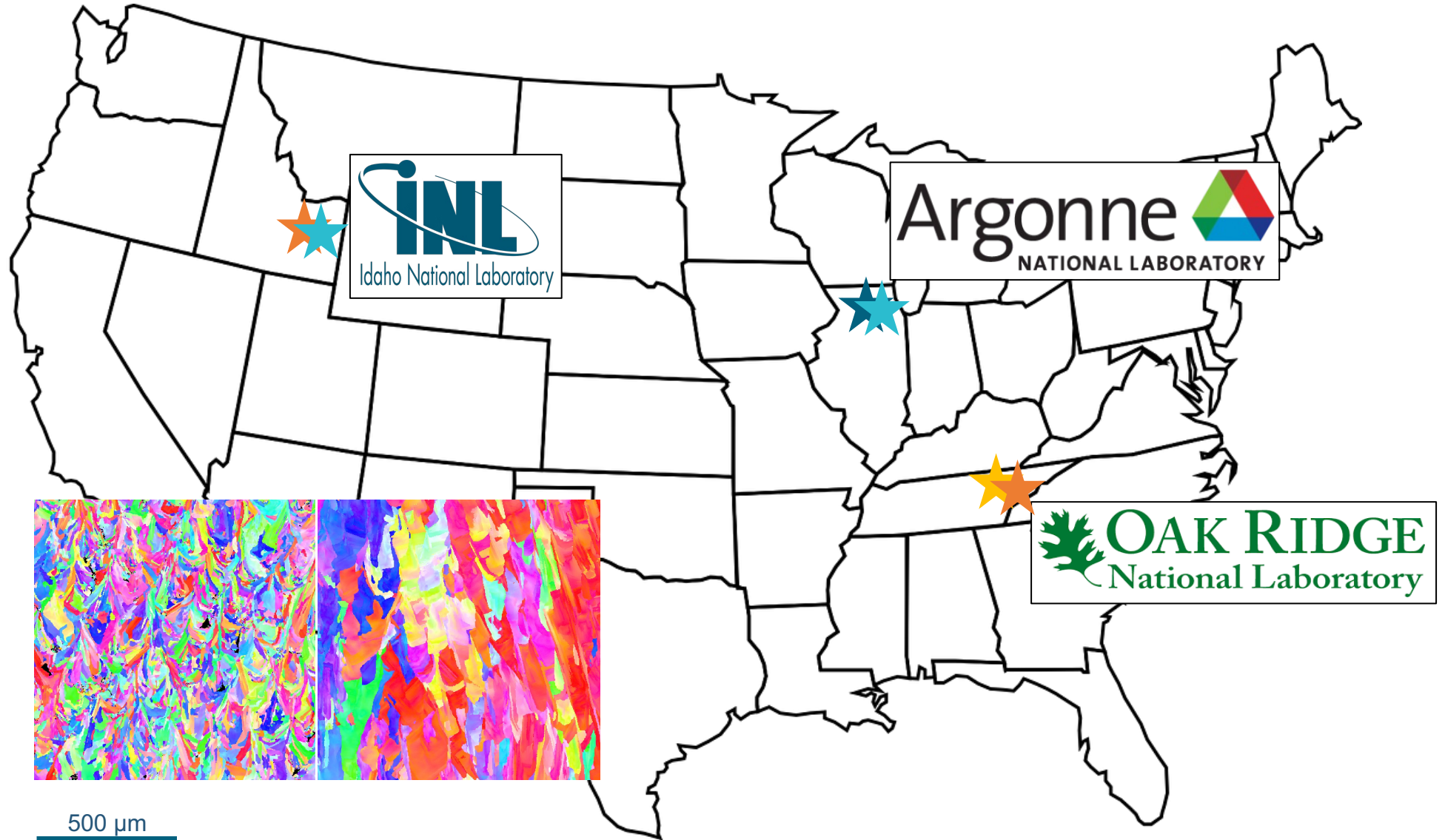
Surveillance specimens



Obtain long-term data to improve models

An integrated environmental effects testing strategy for AM 316H and other materials

- ★ Build
- ★ Ions
- ★ Neutrons
- ★ Corrosion



Activities in the Environmental Effects area

