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Recent Progress in U-10Mo Mechanical and Thermophysical Property Characterization

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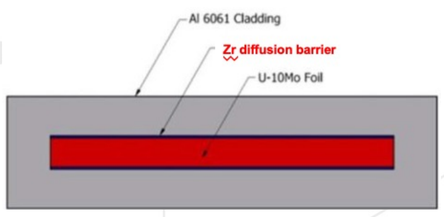
- **Motivation/Project Objectives:**
- Fuel Qualification efforts have progressed beyond laboratory scale fabricated materials, to commercially fabricated materials
- Fuel Qualification requires that material properties be known.
  - Necessary for final safety analysis and licensing reports

- **Technical Challenges:**
- First time commercially fabricated materials were available for evaluation
- Material constraints limit experimental options
- Paucity of data for material under relevant irradiation conditions

- **Approach:**
- Use unirradiated bare foil material to establish baseline for both mechanical and thermophysical properties measured using bulk experimental methods
- Use 4-point bending for mechanical strength evaluation of irradiated materials
- Use newly installed shielded equipment for bulk thermophysical properties of both bare foil and plate configuration unirradiated material
- Evaluate local thermal diffusivity by thermal reflectance (Thermal Conductivity Microscope
- Develop a 5-layer heat transfer model that is solved by finite element analysis

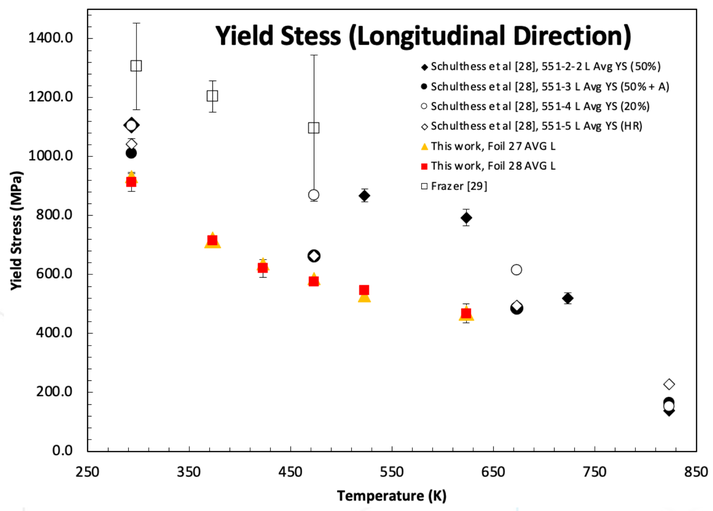
- **Novelty:**
- Measurement of material properties, for materials fabricated commercially and under relevant irradiation conditions
- Finite element analysis of 5-layered heat transfer model to find thermophysical properties of material in plate condition
- Local thermal diffusivity measurement for comparison to both bulk and finite element model

Results

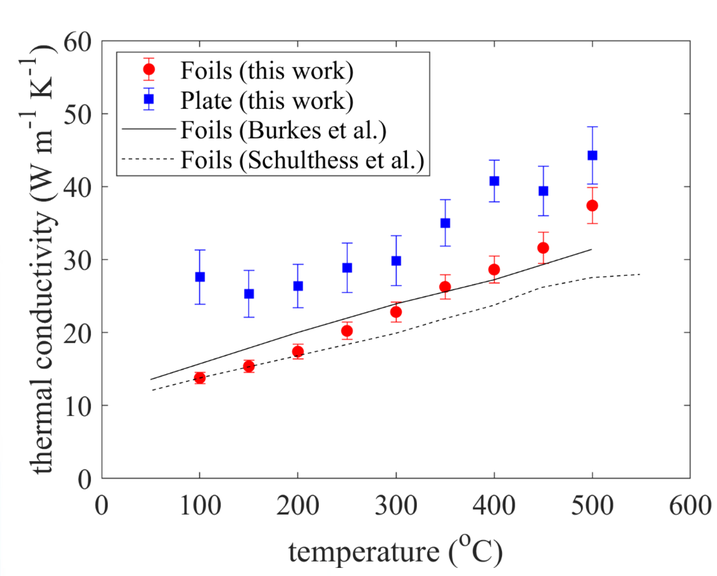


Notional configuration of U-10Mo plate fuel

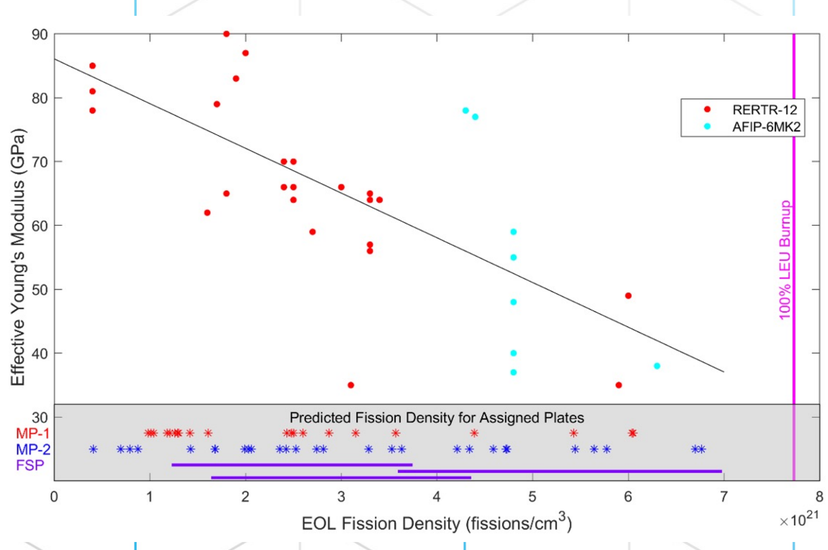
- **Key Results:**
- Bulk mechanical and thermophysical properties evaluated on unirradiated commercially fabricated material.
- Local thermal diffusivity is consistent with bulk foil results (not shown)
- Pending work to fill in gaps in data with material under relevant irradiation conditions
- Additional work planned to better understand thermophysical properties measured on plate material

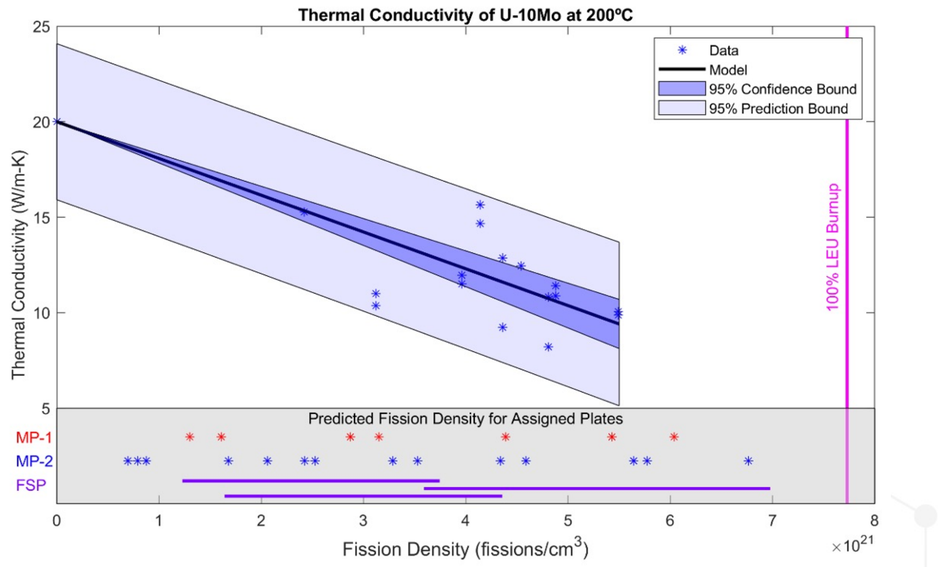


The commercial fabricated unirradiated material shows much more consistent results than the lab fabricated material. Also, no difference in yield between the two foils.



Foil data shows good agreement with previous literature. Fuel plate data trends higher compared to foil and is due to higher diffusivity and specific heat measurements that may be related to a mixed radiation-conduction heat transfer mechanism due to the aluminum alloy surface being semi-transparent at the laser wavelength.





Expected available materials from upcoming irradiation experiments will fill in gaps for both mechanical and thermophysical property data.

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