WBC NEW PROJECT PROPOSAL

Project Title:	Robust fire test method for the performance evaluation of wood-based composites				
Expected Duration:	1 year	**Start Date:**	09/01/2024	**Site:**	Auburn University
Investigator(s):	Zahra Naghizadeh, David Scarborough, Maria S. Peresin			**Submitted by:**	Maria S. Peresin
Related to Topic/Theme:	Q-01-HI: Identifying Adhesive Bondline Quality to Improve Cross-Laminated Timber Performance				

GOALS & OBJECTIVES:

- Develop an inexpensive method for quickly and efficiently evaluating the fire resistance and flame spread properties of small samples of wood products.
- Understand how non-uniformities such as adhesive joints, knots, and cracks affect the fire resistance of the base material.

The Problems:

The two existing standardized methods (E-84 and E-119) provide a uniform method for evaluating the fire resistance across the industry. However, these tests:

1) Large samples 2) Time-consuming 3) Expensive to conduct.

EXPECTED PRACTICAL IMPLICATIONS / IMPACTS:

1) Develop a method to quickly evaluate the fire performance of wood-based materials under different fire scenarios.

2) Measure the effect of the wood products' defects and bond line imperfection on the fire test results.

OUTCOMES & DELIVERABLES:

TASK	DELIVERABLE	Q1	Q2	Q3	Q4
Study different fire test geometries (vertical, horizontal, and angled) to evaluate wood products.	Fire test method development	■	■	■	
Develop a small version of the tunnel test to compare and validate the results	Mini tunnel test	■			
Study the effect of the wood products' defects on the test results.	Data on the effect of defects		■	■	
Evaluate the proposed method and approach for adhesive joints.	Test method for adhesive joints		■	■	

Budget Justification & Request for Funding:

Funding for future MSc student:

GRA & benefits: 12 months

Tuition: 10%

Materials costs:

General lab supplies

Budget	
1 yr expenses	$52,599
GRA & Benefits	$22,920
Tuition and Fees	$2,300
Materials/Supplies	$7,000
Year 1 Total	$52,599

EXPERIMENTAL PLAN:

- The sample will be exposed to different geometries of fire of known heat release and mass flow rates positioned at different locations relative to the sample.

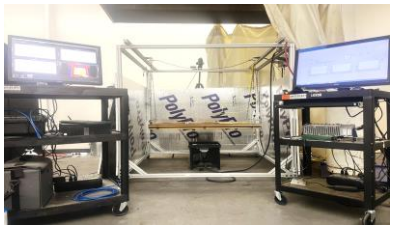
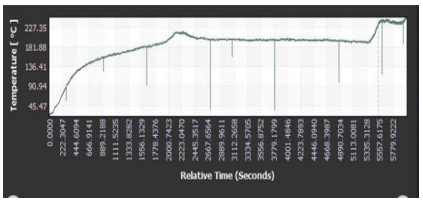


Fig.1. Fire test set up.

- The method used infrared thermal imaging and dynamic load cells to simultaneously determine the temporal and spatial variation of sample surface temperature and temporal variation in sample mass loss.
- From the IR camera, maximum temperature at the back side of the sample vs time will be determined, and the time to reach 230 °C will be recorded.



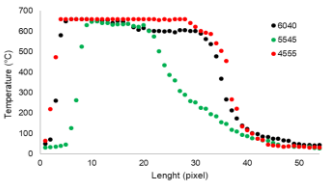


Fig. 2. Maximum temperature vs time (left), flame spread rate (right)

- The results will be reported as mass loss per time to reach a specific temperature and fire spread rate.
- We will test this method for adhesive joints and will study the effect of defects (knots, cracks, etc.) in either wood or composite on the fire test results.

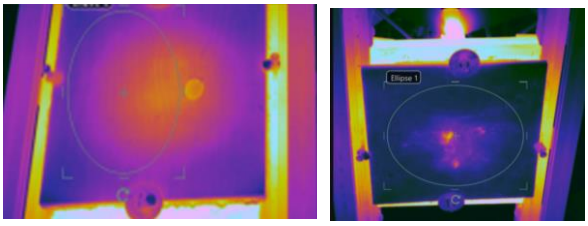


Fig.3. Effect of defects on the fire test results.

- A small-scale tunnel test equipment, ASTM E84, will be built to compare the results with and to validate the proposed method.
- TRL of this project is 5-6, considering successful proof of concept in our prior work and conducted studies and if funded, at the end of one-year proposal, we will be able to increase the TRL level to 7-8.