

PROJECT TITLE:	Enhancing Coating Performance on Profiled Medium-Density Fiber Boards (MDF)		
EXPECTED DURATION:	1 Year	START DATE:	May 1, 2024
INVESTIGATOR(S):	Mojgan Nejad, Chip Frazier, and Brian Love	SUBMITTED BY:	Mojgan Nejad, Chip Frazier, and Brian Love
RELATED TO TOPIC/THEME:	Topic 2024-1 & 2.		

DESCRIPTION

Cabinet producers are increasingly using medium-density fiberboard (MDF) for cabinet facing. When MDF is shaped and profiled, the subsequent coating can exhibit poor film quality on the shaped/profiled surfaces. This is due to the variable panel density associated with the vertical density profile; shaped & profiled surfaces often occur in MDF's low-density, high-porosity regions, resulting in poor film uniformity (thickness) of the primer/coating systems in these areas. There is a need to consider how fundamental MDF manufacturing parameters impact coating performance on shaped and profiled MDF. We suggest that the effects of the vertical density profile be viewed in the context of coating performance. **Roseburg** agreed to provide MDF panels with various density profiles. **AkzoNobel** is interested in evaluating the profiled MDF surfaces using a 3D profilometer before and after applying a solventborne primer. We propose using a flat router to create profiles at different depths through the vertical density profile on MDF panels with various densities supplied by Roseburg to find a correlation between profiled MDF surface properties and primer uniformity. We will follow the spray parameters recommended by AkzoNobel to apply a white solventborne primer on the surface of the profiled MDF at MSU. The primary tasks, detailed below, will be 1) measuring the properties of the primer, 2) analyzing the surface properties of profiled MDF with various vertical density profiles, and 3) primer-film quality analysis.

EXPERIMENTAL PLAN

1. Develop a protocol for measuring the surface properties of profiled MDF before and after primer applications through diverse microscopic techniques such as Confocal Laser Scanning Microscopy (CLSM) and/or 3D surface profiler (VR). These methods enable the assessment of board surface roughness, coupled with image analysis, to quantitatively determine how fluctuation in the MDF density profile impacts the uniformity of the primer film layer.
2. Analyze the properties of solventborne primer, including surface tension (tensiometer), rheology (Rheometer), Tg (DCS), solid content, and contact angle on MDF and fresh profiled samples.
3. Assess the uniformity of primer coating film thickness when sprayed on various MDF profiled surfaces using a 3D surface profilometer and analyze the osmium-tetroxide treated cross-section of samples in backscatter mode with SEM.
4. Find correlations between primer-film uniformity and MDF profiled roughness (partial least square regression chemometric modeling).

RELATED WORK / RELEVANCE

The PIs have extensive expertise in wood coatings and wood composite. Collaborating closely with WBC members, particularly scientists from AkzoNobel and Roseburg, we will conduct a feasibility study in the first year. This study will be a foundation for a longer-term fundamental project focused on coating wood composites.

<p>DELIVERABLES</p> <ul style="list-style-type: none"> • Establish 1st generation MDF-coatings analysis system and protocol. 	<p>MILESTONES</p> <ol style="list-style-type: none"> 1. 1st gen MDF-coatings system and primer-coating analyses. 2. Visualize MDF profiled surface roughness and porosity and their direct impact on coating film uniformity.
<p>POTENTIAL BENEFIT FOR MEMBERS</p> <ul style="list-style-type: none"> • Enhance the use of wood composites in higher-end cabinets, • Creating a new Center research capability that WBC members might value 	<p>BUDGET</p> <p><u>Year 1 Budget Estimate: \$60,000</u></p> <p>Student GRA and benefits: \$36,097</p> <p>Tuition and Fees: \$12,317</p> <p>Travel and Other: \$3,000</p> <p>Materials/Supplies: \$3,822</p> <p>Overhead: \$ 4,764</p> <p style="text-align: right;">Total Yr. 1: \$60,000</p>