Examples of Material Property Testing

Adhesives

ASTM D905 Strength Properties of Adhesive Bonds in Shear by Compression Loading
ASTM D1101 Integrity of Adhesive Joints in Laminated Wood Products for Exterior Use
ASTM D2339 Strength Properties of Adhesives in Two-Ply Wood Construction in Shear
ASTM D2559 Standard Specification for Adhesives for Structural Laminated Wood Products
ASTM D3165 Lap Shear Strength Properties of Adhesives
ASTM D5868 Lap Shear Adhesion for Fiber Reinforced (FRP) Plastic Bonding

Composite Materials

ASTM C393 Flexural Properties of Sandwich Constructions
ASTM D2344 Short-beam Strength of Polymer Matrix Composite Materials and Their Laminates
ASTM D2584 Ignition Loss of Cured Reinforced Resins
ASTM D3039 Tensile Properties of Polymer Matrix Composite Materials
ASTM D3410 Compressive Properties of Composite Materials by Shear Loading
ASTM D3479 Tension-Tension Fatigue of Polymer Matrix Composite Materials
ASTM D3518 In-Plane Shear of Composite Materials by Tensile Test of a ± 45o Laminate
ASTM D4255 Standard Guide for Testing In-plane Shear Properties of Composite Laminates
ASTM D5379 Shear Properties of Composite Materials by the V-Notched Beam Method
ASTM D5528 Mode I Interlaminar Fracture Toughness of Unidirectional Composites
ASTM D5766 Open Hole Tensile Strength of Polymer Matrix Composite Laminates
ASTM D6115 Mode I Fatigue Delamination Growth Onset of Unidirectional Composites
ASTM D6641 Compressive Properties of Composite Laminates
ASTM F1679 Using a Variable Incidence Tribometer (VIT)

Fasteners

ASTM D1761 Standard Test Methods for Mechanical Fasteners in Wood

Plastic Materials

ASTM D256 Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D635 Rate of Burning of Plastics in a Horizontal Position
ASTM D638 Tensile Properties of Plastics
ASTM D695 Compressive Properties of Rigid Plastics
ASTM D696 Coefficient of Linear Thermal Expansion
ASTM D790 Flexural Properties of Plastics
ASTM D792 Density and Specific Gravity of Plastics by Displacement
ASTM D953 Bearing Strength of Plastics
ASTM D2765 Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics
ASTM D3846 In-Plane Shear Strength of Reinforced Plastics
ASTM D4065 Dynamic Mechanical Properties
ASTM D4812 Unnotched Cantilever Beam Impact Strength of Plastics
ASTM D6109 Flexural Properties of Unreinforced and Reinforced Plastic Lumber
ASTM D6110 Determining the Charpy Impact Resistance of Notched Specimens of Plastics

Structural

ASTM C273 Shear Properties of Sandwich Core Materials
ASTM D7032 Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems
ASTM E72 (Sec. 11 only) Conducting Strength Tests of Panels for Building Construction
ASTM E564 Static Load Test for Shear Resistance of Framed Walls for Buildings
ASTM E2126 Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings

Wood Products

ASTM D198 Static Tests of Lumber in Structural Sizes
ASTM D143 Testing Small Clear Specimens of Timber
ASTM D245 Structural Grades and Related Allowable Properties for Visually Graded Lumber
ASTM D1037 Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM D2395 Specific Gravity of Wood and Wood-Based Materials
ASTM D2555 Establishing Clear Wood Strength Values
ASTM D3737 Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)
ASTM D4442 Direct Moisture Content Measurement of Wood and Wood-Base Material
ASTM D4761 Mechanical Properties of Lumber and Wood-Base Structural Material
ASTM D4933 Moisture Conditioning of Wood and Wood-Base Materials
ASTM D5456 Evaluation of Structural Composite Lumber Products
ASTM D6815 Duration of Load and Creep Effects of Wood and Wood-Based Products

IAS ACCREDITED Testing Laboratory

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THE UNIVERSITY OF MAINE

ADVANCED STRUCTURES & composites center

Education, Research, and Economic Development

The University of Maine's Advanced Structures and Composites Center's award winning research staff help clients create innovations from concept through design, modeling, prototyping, testing, and code reports. The 100,000 ft^2, ISO 17025-accredited laboratory employs more than 260 people with expertise in multi-scale materials and structures design and evaluation, composite materials analysis and manufacturing, finite element analysis and multiphysics modeling techniques. We have a successful history of partnering with industry and government, with more than 500 product development and testing projects completed to date.

Our Mission

The University of Maine's Advanced Structures and Composites Center is a world-leading, interdisciplinary center for research, education, and economic development encompassing material sciences, manufacturing, and engineering of composites and structures.

UMaine's Advanced Structures and Composites Center ISO 17025-accredited testing laboratory in Orono, Maine.

13 Integrated Laboratories

Alfond Advanced Manufacturing Lab for Structural Thermoplastics
Alfond W^2 Ocean Engineering Lab
Offshore Wind Lab
Structural Testing Lab
Environmental Testing Lab
Kenway Composite Materials Lab
Materials Characterization Lab
Materials Manufacturing Science Lab
Mechanical Testing Lab
Nanocomposites Processing and Analytical Lab
Polymer and Interface Science Lab
Wood Composites Pilot Line
Thermoplastic Composite Extrusion Lab

IAS ACCREDITED Testing Laboratory

Design & Simulation Capabilities

- Finite element analysis in ANSYS or ABAQUS
- Nonlinear material modeling including impact and fatigue
- Multiphysics simulation in LS-DYNA
- Application-specific analysis software creation
- Finite-element software development
- Fluid-structure analysis in WAMIT or ANSYS Aqwa
- Coupled floating wind turbine analysis in FAST

Manufacturing Capabilities

- World's largest thermoplastic 3D printer (60' long, expandable to 100', 22' wide, 10' tall
- Structural thermoforming
- Thermoplastic vacuum consolidation
- Vacuum assisted resin transfer molding
- Wood-plastic extrusion
- Filament winding
- Compression molding
- Property enhancement using nanomaterials
- Low-logistics concrete formwork
- Hybrid concrete/composite structures

Structural Testing Capabilities

- Total reaction floor space 845 m^2
- Test structures up to 70 m long
- Reaction wall static capacity > 30,000 kN·m
- Reaction wall fatigue capacity > 20,000 kN·m
- Large and small scale fatigue testing
- Offshore model testing
- 10 servohydraulic actuators; 100 to 1,300 kN
- Six winch frames with 130 kN static capacity
- Two MTS inertial resonance excitation systems
- Complete fixturing & instrumentation services
- Extensive digital image correlation capabilities

Testing Equipment

The UMaine Composites Center is an ISO 17025 accredited testing laboratory with nearly 20 years of testing experience meeting industry standards from coupon-scale to full-scale. We have a successful history of partnering with industry and government, with over 500 product development and testing projects completed to date. Our facility includes fully equipped, integrated laboratories to develop and test durable, lightweight, corrosion-resistant material solutions for a wide variety of industries including, among many, offshore wind energy, civil infrastructure, and electrical utilities.

IEC 61400-23 Wind Blade Testing

- Static proof loads to > 30,000 kN·m
- Fatigue loads to > 20,000 kN·m
- Natural frequency and damping measurements
- Blade rotation system with >150 kN·m brake system
- Digital image correlation to characterize surface buckling
- Rolling ultrasonic probe to inspect adhesive joints
- Root stud pull-out testing

Offshore Wind Laboratory reaction wall

Structural Testing Equipment

845 m^2 available reaction floor space

Servohydraulic static and dynamic tests
- MTS and Instron systems

Structural test frames (vertical reaction)
- 3 x 1300 kN capacity
- 1 x 450 kN capacity
- 1 x 220 kN capacity

Structural test walls
- 1 x 3200 kN·m capacity
- 1 x >30,000 kN·m capacity

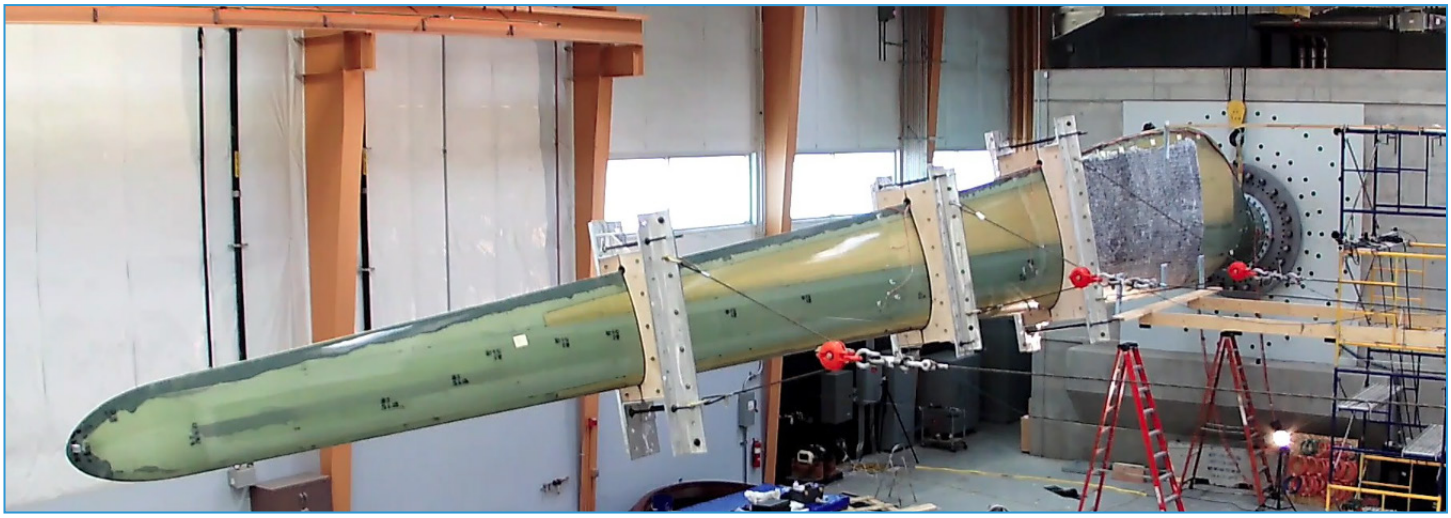
Winch frames
- 6 x 130 kN capacity

Servohydraulic actuators
- 2 x 1300 kN (2000 kN in compression)
- 3 x 450 kN
- 3 x 250 kN
- 2 x 100 kN, 1 high-speed (1.2 m/s)

Hydraulic power stations
- 280 kW in Offshore Wind Laboratory
- 170 kW in Structural Testing Laboratory

Noncontact Displacements and Strains

- GOM ARAMIS optical 3D deformation analysis
- Displacement resolution 0.1 mm over large surfaces
- Strain distributions around joints
- 4 sets of cameras



IEC 61400-23 Wind Blade Testing in our Offshore Wind Laboratory

Material Coupon testing Equipment

Servohydraulic tension-compression test frames
- 1 x 500 kN capacity
- 3 x 100 kN capacity
- 1 x 20 kN capacity

Servohydraulic axial / torsional test frames
- 1 x 100 kN / 1100 N·m capacity
- 1 x 25 kN / 100 N·m capacity

Drop weight impact testing 1.5 - 1250 J

Non-destructive testing

- Phased-array ultrasonic inspection
- Acoustic emission testing
- Embedded fiber optic strain sensing

Microscopy

- Optical microscopy
- Scanning electron microscopy (SEM)
- Environmental SEM
- Transmission electron microscopy
- Atomic force microscopy (AFM)
- Microtomography
- Laser scanning confocal microscopy

Material and Substructure testing

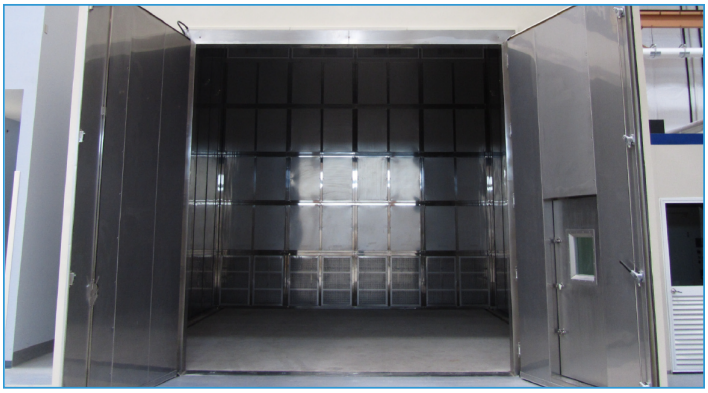
- Plastic, adhesive, composite, and fabric property testing
- Multiaxial strength and stiffness
- Fatigue, creep & impact testing
- Multi-scale tests from constituents to structures

Environmental test chamber

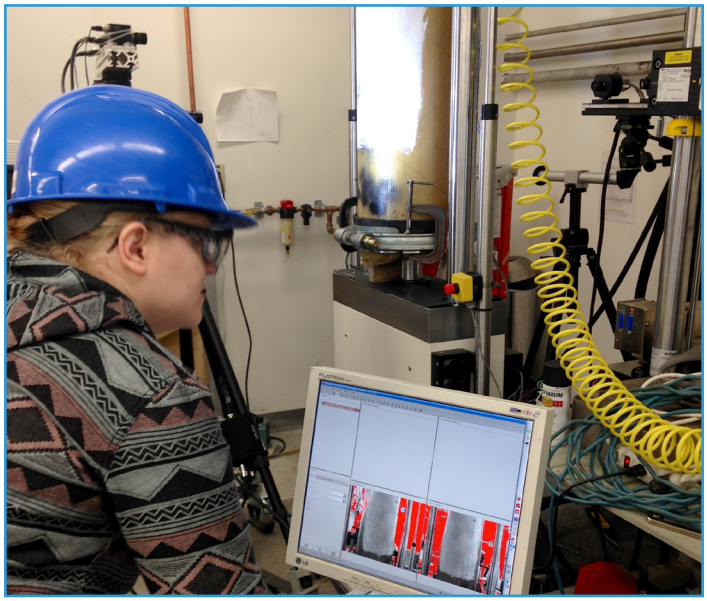
300 m³ chamber (6.8 m x 6.8 m x 6.1 m high)
Door opening 4.3 m x 4.25 m high
Temperature range -40 to +50°C
- Uniformity ±3.0°C, constancy ±0.2°C

Relative humidity range 20 to 95%
- Uniformity ±5%, constancy ±2.5%

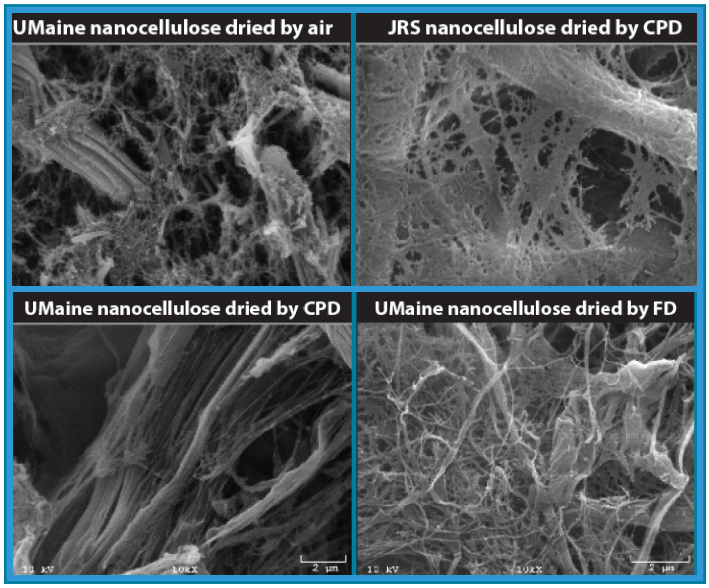
Ramp rate in thermal cycling ±10°C per hour
Conduct fatigue tests within chamber



300 m³ Three-story tall environmental test chamber



Coupon testing in the Mechanical Testing Lab



Nanomaterial development

Panorama of Structural Testing Laboratory