

## ***FACILITIES, EQUIPMENT, AND OTHER RESOURCES***

The High Performance Materials Institute (HPMI) at Florida State University is recognized nationally and internationally as a leader in developing cost-effective high-performance composite materials and systems. HPMI uses feasibility analysis, proof-of-concept demonstration and prototype testing to develop innovative technologies and solutions for the design, manufacturing, and characterization of advanced materials. The institute has a close working relationship with the composite materials industry and government laboratories. HPMI has state-of-the-art composite materials design, processing and characterization equipment.

Most of the equipment is located in the new \$ 21M, 45,000 square foot Materials Research Building. Available resources include:

### **ANALYTICAL EQUIPMENT**

<b>ELECTRICAL PROPERTIES</b>		
	<b>Equipment</b>	<b>Manufacturer</b>
	Function generator (2ea)	Agilent 33220A
	Electrometer	Keithley 6517A
Temperature dependence conductivity measurement system	Cryostat (LN2)	ARS Inc, LC-1
	Temperature controller	Laskshore, 325
	Switch box	Agilent, 3499B
Electrical conductivity (DC)	Current source	Keithley 6221
	Nanovoltmeter	Keithley 2182A
	4 probe measurement station	Jandel
Field-emission test setup	Turbo Cart Pumping station	Varian, V301
	Source-meter (1100 V)	Keithley 2410
	Picoammeter	Keithley 6485
	Multimeter	Keithley 2002
	Multimeter	Keithley 2002
	LCR meter	Hioki,
	Dual source meter unit	Keithley 2636A
High current flow test	IR Camera	
	current source (10A)	VSP 120/10
	source-meter (1100V)	Keithley 2410
UV illumination system (2 set)	<i>Source</i>	<i>Newport 92191-1000</i>
	<i>Power supply</i>	<i>Newport 69922</i>
	<i>controller</i>	<i>Newport 68945</i>
	Lock-in amplifier	AMETEK, signal recovery 7265
	Electrochemical measurement system (CV, potentiostat, galvanostat etc)	AMETEK, VersaSTAT 4
	Impedance analyzer	Solartron 1260
	micro manipulator (2ea)	
	battery analyzer	MTI
	Electrometer	Keithley 6514

<b>SPECTROSCOPY</b>		
	<b>Equipment</b>	<b>Manufacturer</b>
	Raman Microscope	Renishaw, Inc., inVia Raman
	X-ray scattering	Bruker, Nanostar
	UV-VIS-NIR Spectrophotometer	Varian, Inc., Cary 5000
	FT-IR with Microscopy	Thermo Nicolet, NEXUS 470
	Zeta Potential and Particle Size Analyzer	Beckman Coulter, Delsa Nano C
	Benchtop Ultra Centrifuge	Beckman Coulter, Optima MAX XP
<b>MICROSCOPY SYSTEMS</b>		
	<b>Equipment</b>	<b>Manufacturer</b>
	Atomic Force Microscope (AFM)	Veeco Instruments Inc., Multimode with nanoscope V
	Optical Microscope	Olympus, BX40
	CytoViva™ Microscope	CytoViva, Inc., CytoViva System with DMF
	Stereo/Optical Combination Microscope	Carl Zeiss, SV-11 Apo
	Scanning Electron Microscope (SEM)	JEOL 7401F, FE and EDAX
	Auto/Manual High Resolution Sputter Coater	Polaron, SC7640
	Optical Microscope	VWR, vista vision
<b>OTHER ANALYTICAL EQUIPMENT</b>		
	<b>Equipment</b>	<b>Manufacturer</b>
	Surface Area and Porosity Analyzer	Micrometrics Inc., Tristar
	Viscometer (2ea)	Brookfield
Actuation measurement system	Precision laser gauge	MTI instruments, Microtrack II
	Vibration isolation table	Isoplate
	Function generator	Agilent, 33220A
	C-Scan	SONIX Corp., SONIKK System
	Thickness gauge	Heidenhain
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	QCM & QMS gas analyzer	SRS

### **COMPOSITE FABRICATION AND TOOLING**

<b>Equipment</b>	<b>Manufacturer</b>
Integrated Continuous Buckypaper Fabrication Station	HPMI in-house development
Hot Press (24" x 24") 150 ton	Wabash MPI, DAV150H-24-X
MPI Hot Press 24"x24" 75 ton	Wabash, G50H-18-C2
Hot Press (12" x 12")	Carver Inc, 4394-4PR 3000 AutoFour/30, 30T/650650°F,
Hot Press (6"x6")	Carver Inc, 3851-0, 24,000lbs/650°F,
Laser Cutting Machine	Engraving System Support, Inc., ULS-M300
Infrared Oven	PDQ, 6-B
Small RIDFT Machine (Round)	HPMI in-house development
Small RIDFT Machine (Rectangular)	HPMI in-house development

Mid-Sized RIDFT Machine	HPMI in-house development
UV Curing Setup, 15"×15" (2ea)	Fusion UV, Inc. FS600
Temperature/Humidity Test Chamber	Russells, Inc., GD-16-3-3
Vacuum Oven	Cole-Parmer, StableTemp 282A
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Conveyorized Fabric Cutter	GERBER Co., GTxL
Walk-In Oven	Precision Quincy Corp., Model 74-800
High Shear Mixer	Charles Ross & Son Company, HSM -100LCI
High Pressure Foaming and Deposition System	HPMI in-house development
High Pressure Reactor System (2ea)	HPMI in-house development
Microfluidizer High Shear Processor	Microfluidics Corp., M-110P
Mini-Extruder and Pelletizer	Custom Scientific Instruments Inc., LE-075 & CSI-194C
Centrifuge	Hermle-Labor Technik, Labnet Z206A
Autoclave	ASC, Econoclave EC3X6
CO2 incubator	Binder
Laser cutting system for BP	Versa Laser, 10W power
Rapid Prototyping Machine	Z Corporation, Spectrum Z510
Waterjet Cutter	OMAX Co., OMAX 55100/30
CNC	HAAS, VF2
Rotary evaporator	Buchi, Rotavapor R205
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Ultramicrotome	Leica Microsystems, EM UC6
Cryo Chamber	Leica Microsystems, EM FC6
Non-contact 3D Digitizer/Scanner	Minolta, Vivid 910
3D printer	Objet 30
Box furnace (2)	Vulcan, 3-1750
Box furnace	Zircar, Hotspot 110
Drop Weight Tester	HPMI in-house development
Polishing machine	UKAM INDUSTRIAL Inc.
SAW	UKAM INDUSTRIAL Inc.
Sieve Shaker SS-8R	Gilson
30 Ton Hydraulic Press	
Cascade camera	CCD
3 - Vacuum ovens	Fisher Scientific, isotemp 280A
Box furnace	VWR 1321F
Glove Box system	VAC, OMNI-LAB
High temperature tube furnace	MTI corporation, GSL 1700X
High temperature tube furnace	MTI corporation, GSL 1600X
Small hot press	Specac (15 ton max)
Spin Coater	Specialty Coating System, G3P-8
Optical table	Thorlab
Chemical Vapor Deposition	CVD equipment Co, Easy Tube 3000
CMM	Brown&Sharpe, Inc., GAGE 2000r
Freezers	(CABREPLO)
M3D Aerosol Jet Deposition System	Optomec
Hot Press (12"×12")	Carver Inc, 3895 AutoFour/30, 30T/650650°F
Ductless Fume Hood	Misonix Co., Aura

3 Roll mixing machine	Exakt 80E
Oven	Teio Tech, OF-02G
Superconducting magnet - 5T maximum, 20 cm bore size	AMI
Sonicators (8 )	Misonix, 3000
Continuous sonicator (2 ea)	Misonix, 3000 with flow cell
Portable hood (2ea)	Misonix, Aura750
Bath sonicator (3ea)	2 Branson, 5510 & 1 Cole-Parmer 8892
Antistatic device for balance	Haug, PRX-U

### **THERMAL ANALYSIS EQUIPMENT**

<b>Equipment</b>	<b>Manufacturer</b>
Differential Scanning Calorimeter (DSC)	TA Instrument, Inc., DSC Q100
Thermomechanical Analyzer (TMA)	TA Instrument, Inc., TMA2940
Themogravimetric Analyzer (TGA)	TA Instrument, Inc., TGA Q50
Rheometer	(TA Instrument, Inc., ARES-LS3)
Dynamic Mechanical Analyzer (DMA)	TA Instrument, Inc., DMA2980
Dynamic Mechanical Analyzer (DMA)	TA Instrument, Inc., DMA Q800
TG-DSC	Netzschm Jupiter F1
Laser Flash Thermal physical property measurement system	Netzsch, LFA457 MicroFlash

### **MECHANICAL TEST EQUIPMENT**

<b>Equipment</b>	<b>Manufacturer</b>
Mechanical Test Machine	Shimadzu Co., AGS-J
Video extensometer system	Shimadzu Co., DVE-201
MTS Insight Testing System, 1KN Standard Length)	MTS
MTS Landmark Servo-hydraulic System	MTS
3D camera system for MTS	Dantec, Q-400
MTS 858 Table Top System	MTS