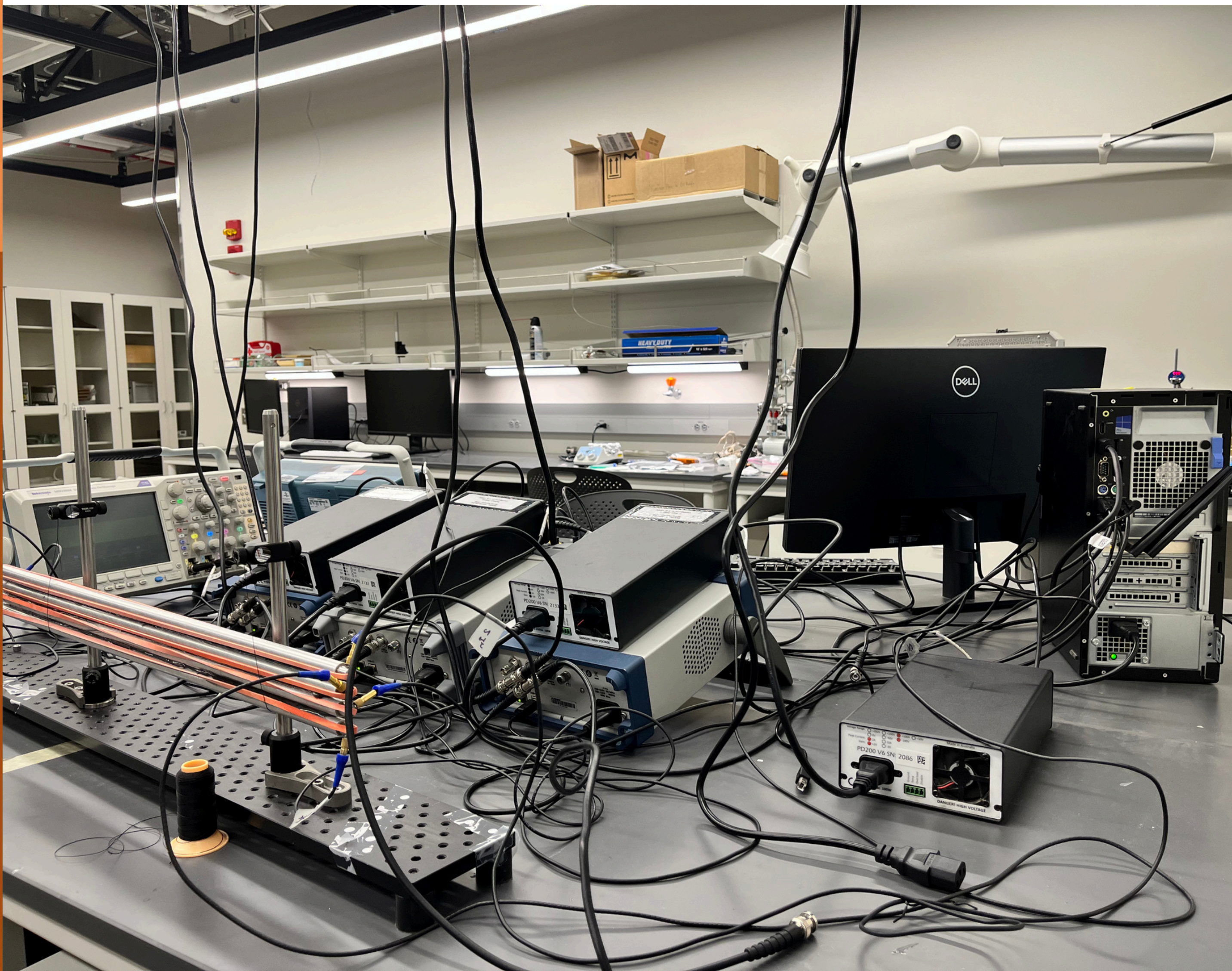
NEW FRONTIERS OF SOUND

Equipment Catalog

30+ shared research instruments

This catalog highlights over 30 shared research instruments available across the New Frontiers of Sound Science and Technology Center (NewFoS), hosted by 9 academic partner institutions. These tools support cutting-edge research in topological acoustics, quantum-inspired sensing, thermal analysis, spectroscopy, imaging, and advanced materials characterization.



THERMAL ANALYSIS

Mettler Toledo Differential Scanning Calorimeter (DSC 1)

Description

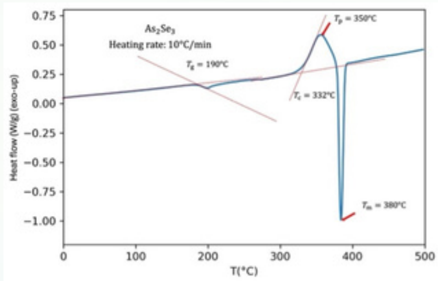
Differential Scanning Calorimetry (DSC) measures heat flow into or out of a material as it is heated, cooled, or held isothermally. This technique provides precise information on thermal transitions including the glass transition temperature (Tg), crystallization onset (Tc), crystallization peak temperature (Tp), and melting temperature (Tm).

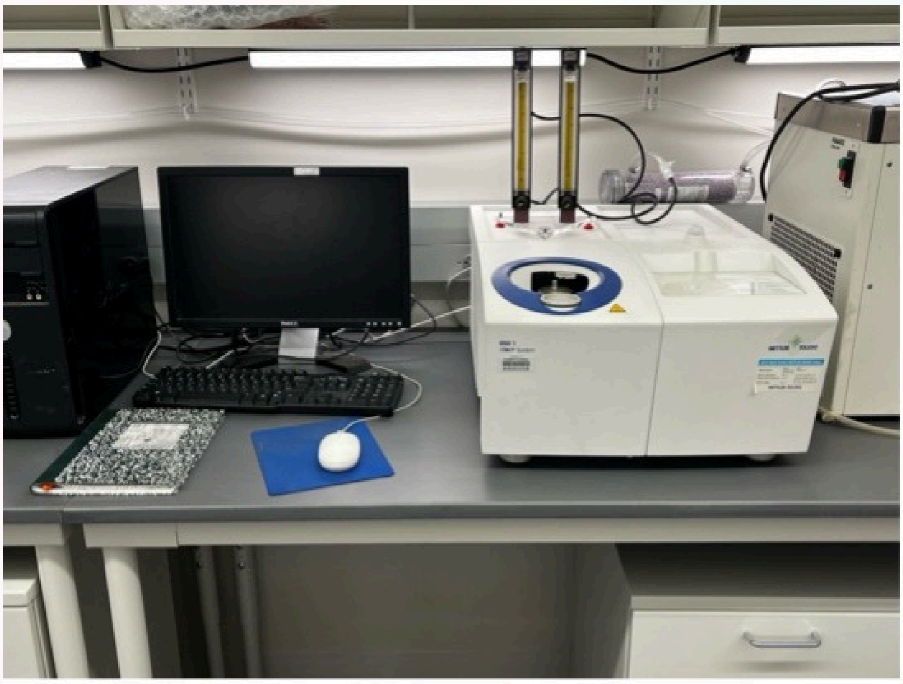
It is particularly useful for polymers, glasses, and other materials whose physical or chemical structure changes with temperature. The system delivers reliable performance for routine thermal analysis and research-grade experiments.

Specifications:

- Temperature range: -50 °C to 450 °C
- Preferred sample mass: 5-20 mg
- Heating rate: 0.02 °C/min to 300 °C/min
- Cooling rate: 0.02 °C/min to 50 °C/min

Example





Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda, Dmitriy Pavlovich Bayko, Tanvir Mahtab Shuvo
Shared Access: YES

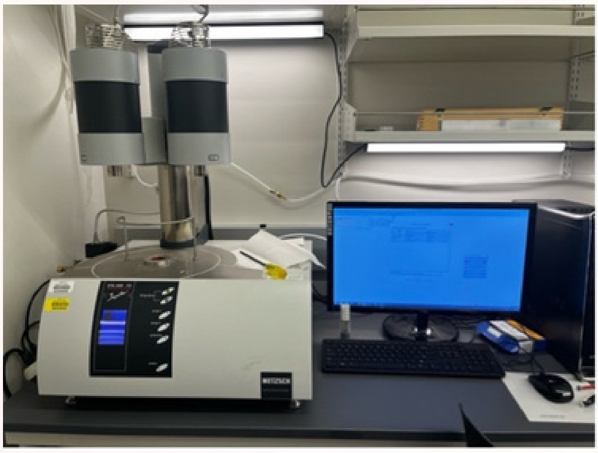
Netzsch STA 449 F3 Jupiter (Simultaneous DSC/TGA/DTA)

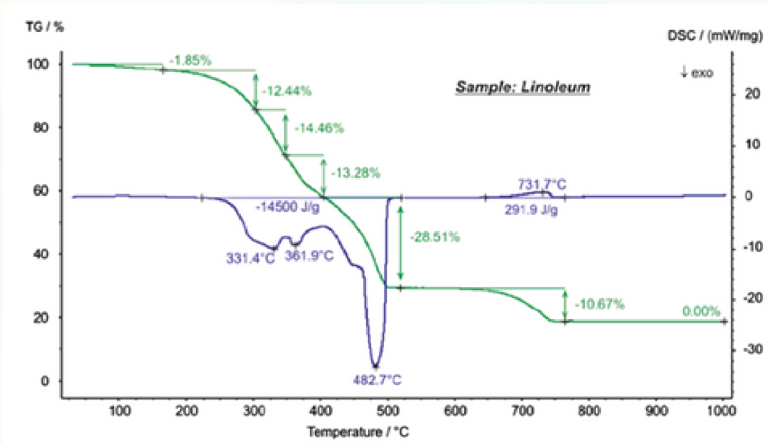
Description

This instrument combines Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), and Differential Thermal Analysis (DTA) into a single unit to measure both heat flow and mass change of a material simultaneously. It is ideal for studying complex thermal events such as degradation, oxidation, or compositional changes in polymers, composites, and other functional materials.

Specifications:

- Heating rate: 0.001 °C/min to 50 °C/min
- Temperature resolution: 0.001 °C
- Balance resolution: 0.1 µg
- Balance drift: <0.5 µg/hour
- Atmospheres: N_2 (purge), Ar (protective)
- Two furnace options for broader experimental range





Typical STA Thermogram Showing Heat Flow and Mass Change for a Linoleum Sample

Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda, Dmitriy Pavlovich Bayko, Tanvir Mahtab Shuvo
Shared Access: YES

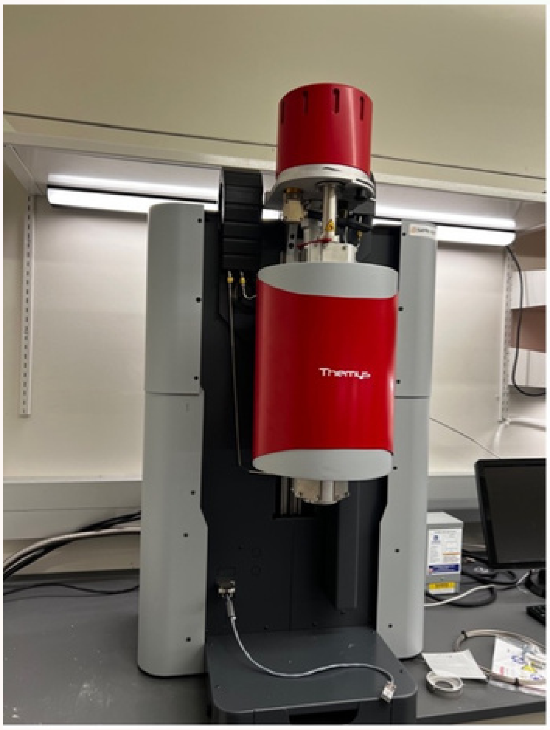
Themys Thermal Analyzer

Description

The Thermys Thermal Analyzer enables simultaneous thermogravimetric analysis (TGA) and differential thermal analysis (DTA) over a wide temperature range, making it ideal for advanced materials research and thermal stability studies. With ultra-sensitive balance resolution and high thermal precision, this system supports precise characterization of phase transitions, decomposition behavior, and mass changes under controlled inert atmospheres.

Specifications:

- Temperature Range: Ambient to 1600 °C
- Temperature Resolution: ±0.8 °C
- Heating Rate: 0.01 to 100 °C/min
- Balance Resolution (high sensitivity mode): 5.9×10^{-4} µg
- Balance Drift: ±3 µg
- Atmosphere: Argon (Ar)



Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda, Dmitriy Pavlovich Bayko, Tanvir Mahtab Shuvo
Shared Access: YES

Bruker Tensor 27 FTIR Spectrometer

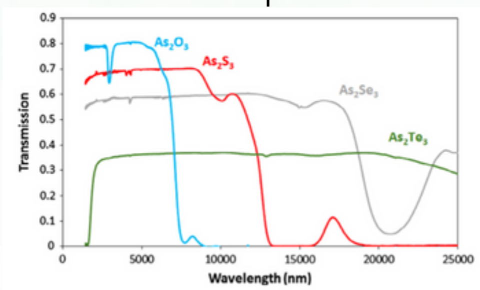
Description

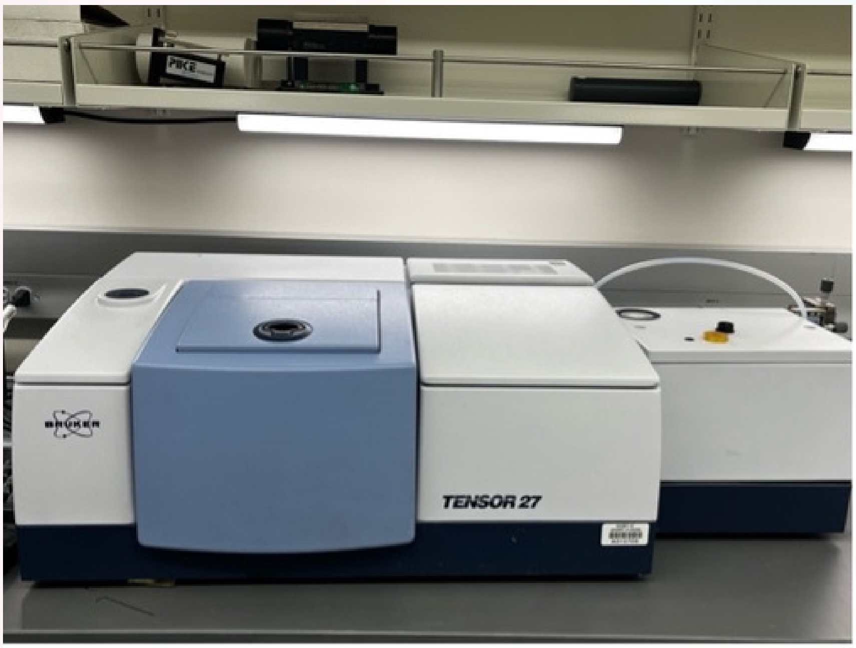
Fourier Transform Infrared Spectroscopy (FTIR) is used to identify functional groups and molecular structures by measuring the absorbance of infrared light through a sample. The Bruker Tensor 27 provides high-resolution transmission spectra, and is especially suited for analyzing chalcogenide glasses, polymers, and complex oxides.

Specifications:

- Spectral range: 400-1400 cm^{-1}

Example





Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

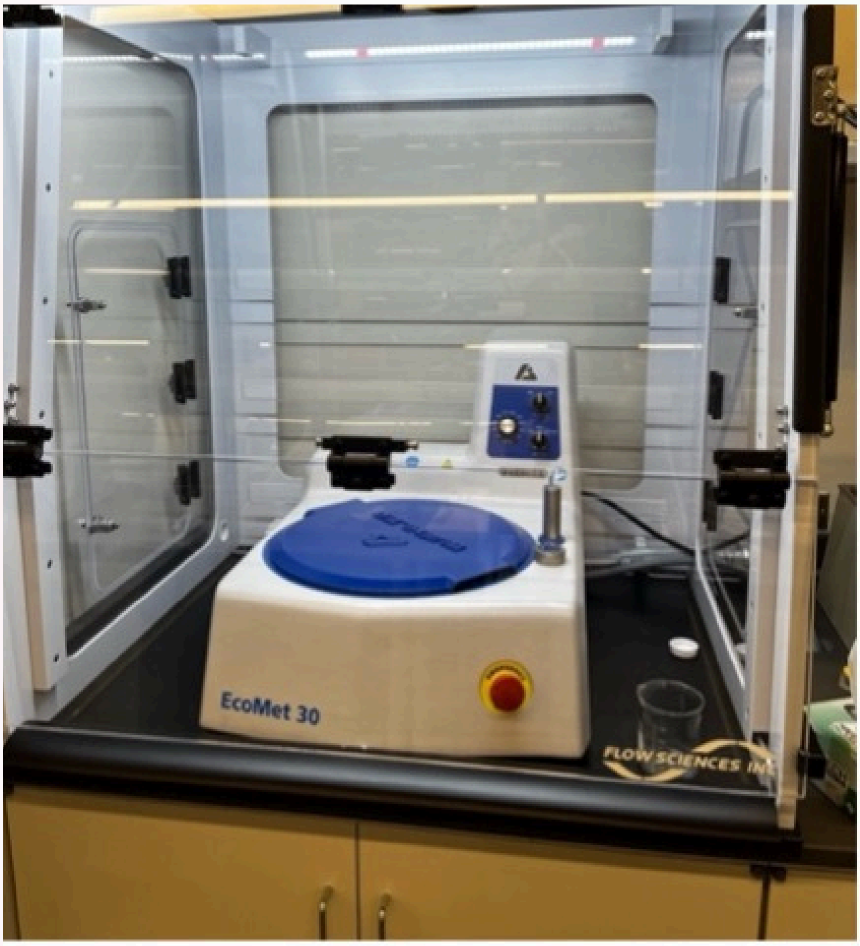
SAMPLE PREPARATION & PROCESSING

Buehler EcoMet 30 Polisher

Description

A precision polishing system with variable-speed control for reproducible surface preparation. Its enclosed design minimizes airborne contaminants and increases operator safety. The system supports a wide variety of consumables and is optimized for specimens requiring SEM, EBSD, or optical microscopy.

Use Cases: Metallic alloys, ceramics, chalcogenide glasses, and composites.



Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

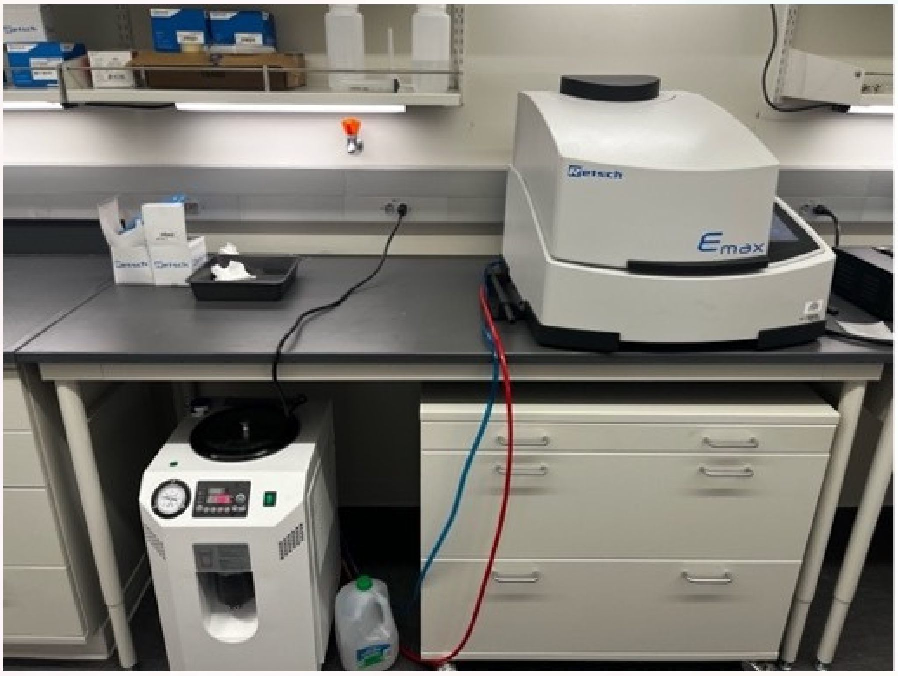
Retsch Emax Ball Mill (with Cooling System)

Description

A high-energy ball mill equipped with tungsten carbide containers and media, plus a water cooling system that prevents frictional heating. This is especially useful for milling temperature-sensitive materials.

Specifications:

- Volume: 50 mL
- Speed: 300-2000 RPM
- Milling media sizes: 3, 4, 5, 6, 10, 12 mm diameter



Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

SAMPLE PREPARATION & PROCESSING

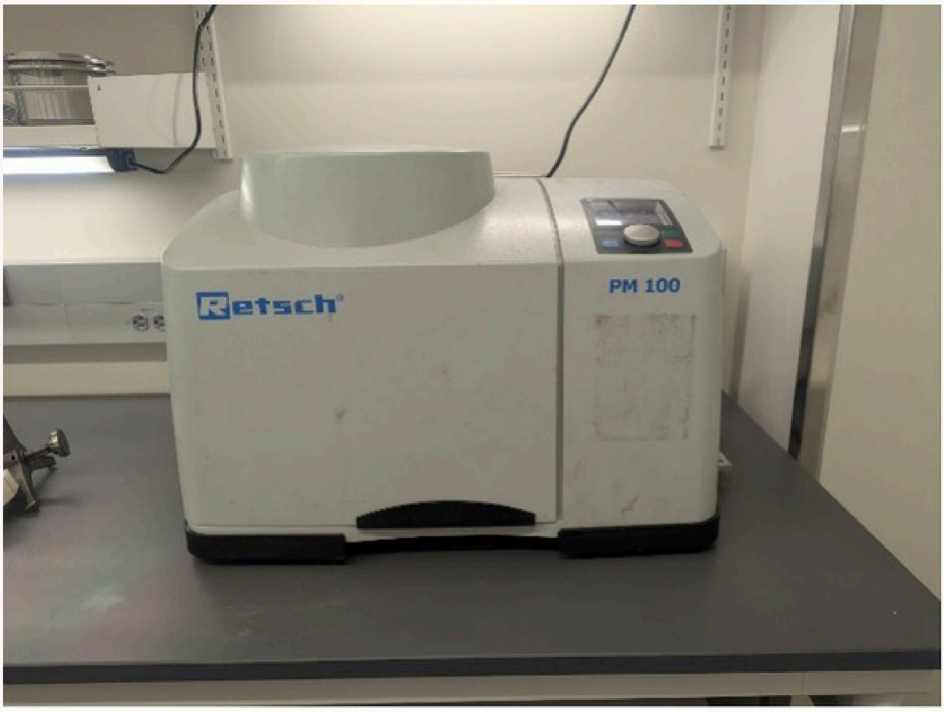
Retsch PM-100
Planetary Ball Mill

Description

Planetary ball mill with tungsten carbide container and 10 mm media for efficient grinding and mixing of hard and brittle materials.

Specifications:

- Volume: 50 mL
- Speed: 100-600 RPM



Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

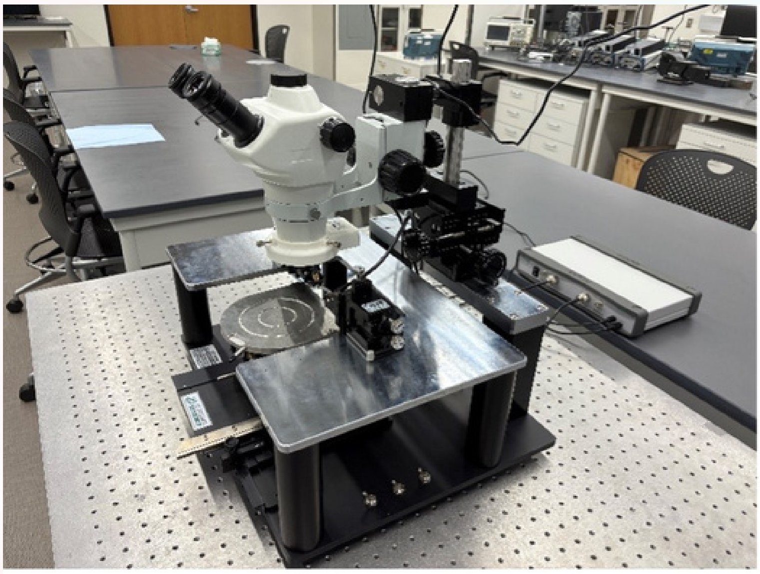
Everbeing C-R6F Probe Station

Description

The C-6 probe station is an interface tool to measure the electrical characteristics of microelectronic devices. The C-R6F series includes additional U-shaped chuck with auxiliary for contact and calibration substrates, and a fine theta screw to assist in aligning devices with probes. The station combines with a microscope and micropositioners to facilitate the experiment. When integrated, users can accurately make contact to their devices with probes and measure with electronic meters to see results. Potential applications include but not limited to basic IV/CV, broadband probing for RF devices, and photonics.

Specifications:

- Microscope Magnification Range: 20x-100x
- Platen Dimension: 250 mm Inner, 450mm Outer
- Platen Capacity: 12 DC or 4 RF 4 DC
- Chuck Quick Resolution: 25 mm/rev
- Chuck Fine Resolution: 1 µm
- Chuck Theta Coarse Travel: 360°
- Chuck Z-Motion: 4 mm Range



Location: GCRB 6th floor, University of Arizona
Responsible PI(s): Zafer Mutlu and Ho I-Ting (Andy)
Shared Access: YES

Fiber Drawing Tower

Description

A computer-controlled system designed for drawing glass fibers from bulk preforms. The vertical furnace and tension control mechanism ensure high uniformity and consistent diameters across fiber spools. Capable of processing advanced materials like chalcogenide glasses for mid-IR photonics applications.

Notable Feature:

Successfully drawn $As_{38}Se_{62}$ fibers with Tg = 430 K and Tm = 800 K.

Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

Glove Boxes

Description

Three inert atmosphere glove boxes: two single-user units for thin film synthesis and one dual-user glove box dedicated to ultra-high purity work, including synthesis of chalcogenide glasses.

Atmosphere control:

- <0.1 ppm O_2 and H_2O

Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

Fume Hoods

Description

Three chemical fume hoods for specific applications:

1. Acid-based processes
2. Arsenic-related work
3. General chemical use

Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

Vacuum Sealing Equipment

Description

Two turbo pump vacuum stations capable of achieving $<10^{-4}$ hPa pressure, ideal for high-vacuum environments. Includes a hydrogen-oxygen torch with interchangeable nozzles for precision flame sealing of ampoules and quartz tubes.

Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

Furnaces (Annealing & Rocking)

Description

Multiple programmable furnaces for thermal processing:

- Types: Small and large annealing furnaces, and a rocking furnace
- Max temperature: 1100 °C
- Capabilities: Linear ramping, isothermal holds

Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

Tube Furnace (Thermo Scientific TF55035A-1)

Description

This tube furnace is able to perform heat treatment by ramping up the temperatures between 100 °C to 1100 °C via assigned segments. Adjustable high-limit overtemperature protection is included in the program to prevent overheating. The furnace is equipped with a Type K long-life thermocouple to precisely monitor the internal temperature, and the tube design permits the assembling of vacuum pump or gas supplies (e.g. Ar, N_2, etc.) to satisfy the requirements for heat-treatments under specific environments. This furnace is currently serving for fabrication of RF or electrical devices.

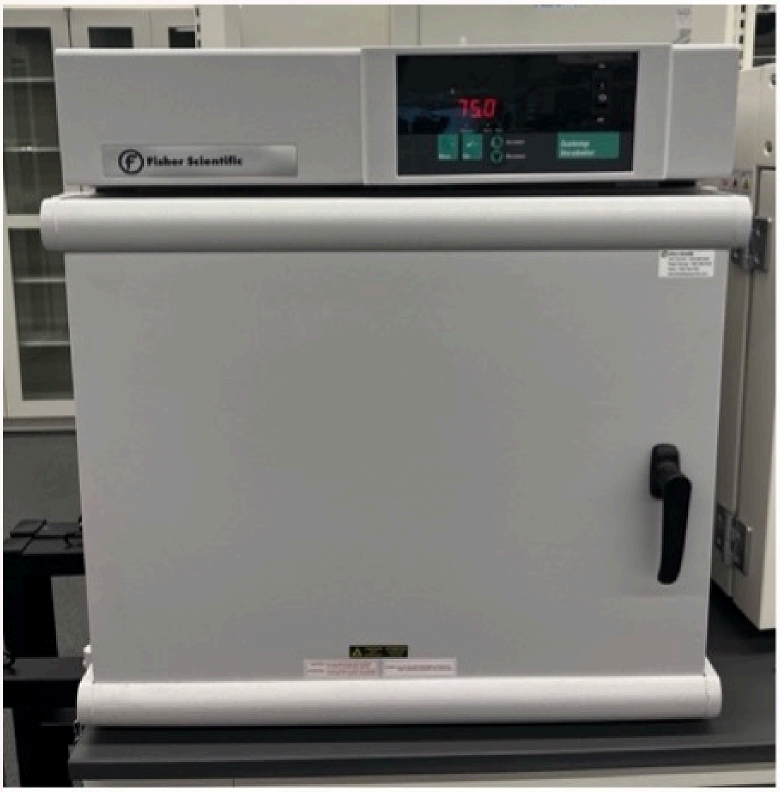
Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda and Ho I-Ting (Andy)
Shared Access: YES

Incubators / Drying Oven

Description

Environmental chamber and oven for sample drying and low-temperature annealing.

- Incubators: 30-75 °C
- Drying Oven: 140 °C

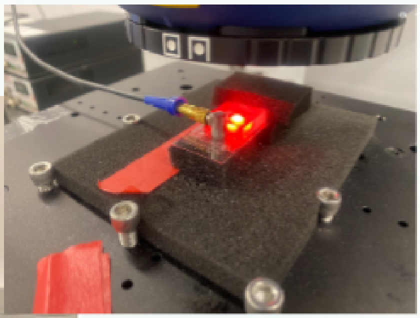


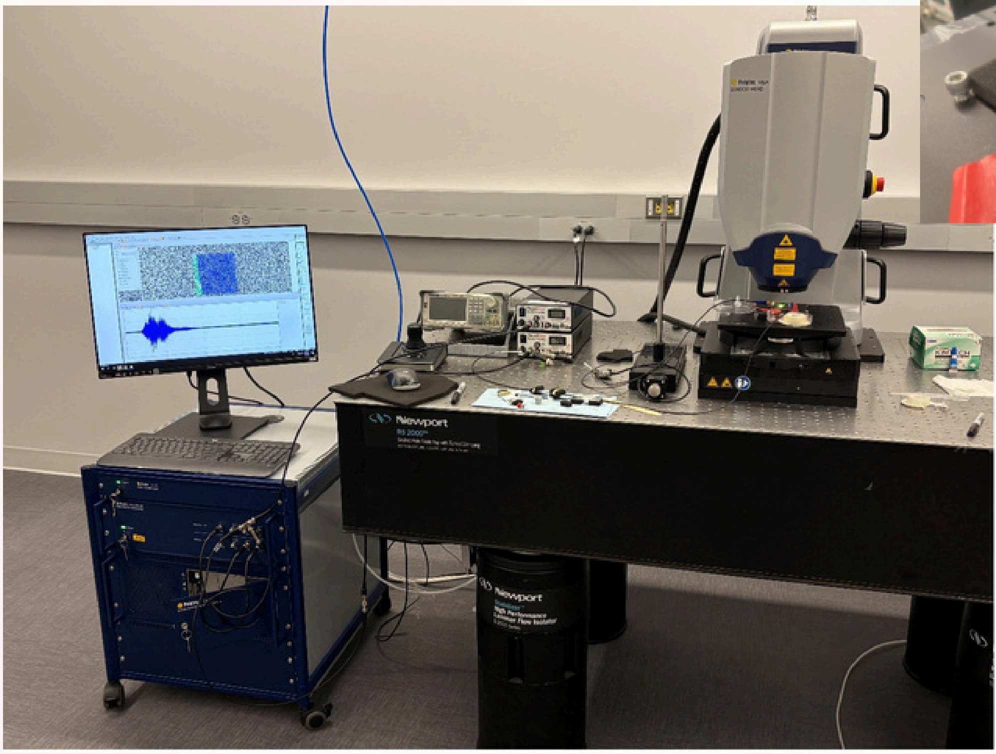
Location: Lucas Lab, University of Arizona
Responsible PI(s): Wataru Takeda
Shared Access: YES

Polytec MSA-100-3D
Micro system analyzer

Description

Standing out from the normal SLDV systems, this micro system analyzer allows you to conduct measurements of acoustical response in all three spatial directions that are recorded simultaneously in high resolution and are analyzed as an integrated data record. This SLDV is equipped with a laser with spot size less than 4 µm and a high bandwidth of up to 2.5 MHz, enabling characterizing features down to the microscales. Coupling with the embedded software, measurements of either single point or points arrays in selected area with graphical representation can be easily achieved. The vibration of samples can be generated by either embedded junction box or external signal generator so flexible waveform generation can be achieved for specific targets. Potential application includes characterizing microelectromechanical sensors and actuators (MEMS), as well as microstructural characterization involving non-linearity such as defects, inclusions, etc.





Location: Deymier Lab, University of Arizona
Responsible PI(s): Pierre Deymier, Ho I-Ting (Andy)
Shared Access: YES

VIBRATIONS & ACOUSTIC SENSING

Polytec PSV-400 Scanning Laser Doppler Vibrometry (SLDV)

Description

Laser Doppler Vibrometry (LDV) is a remote sensing technique that utilizes the Doppler effect to measure vibrations. This technique observes changes in the frequency of laser light reflected from moving surfaces, allowing for the precise determination of their velocity and thus the amplitude of surface vibrations with respect to the certain axis. Incorporated with the PSV software, scanning of discrete laser spots with controlled distance on an area of interest can be achieved in this SLDV system. This SLDV system includes an interferometer with a He-Ne laser beam that is capable of resolving targets vibrating with frequencies up to 350 kHz and velocities up to 20 m/s. The portable detector further allows the flexibility to capture the targets with sizes from several mm^2 to m^2 range with sufficient spatial resolution. The Polytec PSV-400 SLDV is a great tool to perform non-destructive evaluation for heterogeneous microstructures in mm scales like cracks as well as remote sensing to characterizing TA quantum analogies without the needs of transducers that shift the center of mass on the rods.

Location: Deymier Lab, University of Arizona
Responsible PI(s): Pierre Deymier, Ho I-Ting (Andy)
Shared Access: YES

Polytec Devices from Academic Partners Senior Personnel

Polytec PSV-500 Scanning LDV
Description: Equivalent to PSV-400
Location: Discovery W338, University of Vermont
Responsible PI(s): Jihong Ma, Michael Leamy
Shared Access: YES

Polytec PSV QTec (IR Laser)
Description: 3D scanning LDV system with IR laser for challenging surfaces.
Location: Caltech
Responsible PI(s): Chiara Daraio
Shared Access: YES

Polytec PSV-500 (HeNe Laser)
Description: 3D scanning LDV with helium-neon laser for high precision.
Location: Caltech
Responsible PI(s): Chiara Daraio
Shared Access: YES

Polytec OFV-5000 (2 Systems)
Description: Single-point LDV sensors for high-sensitivity vibration measurement.
Location: Caltech
Responsible PI(s): Chiara Daraio
Shared Access: YES

Polytec CLV-2534 (1 System)
Description: Compact single-point LDV system.
Location: Caltech
Responsible PI(s): Chiara Daraio
Shared Access: YES

Polytec Devices from Academic Partners Senior Personnel

Polytec PSV-500 (ASRC, E3)
Description: 3D scanning LDV system for advanced acoustic characterization.
Location: ASRC
Responsible PI(s): Luca Stefanini, Andrea Alù
Shared Access: YES

Polytec PSV QTec 600F
Description: Full-field optical vibration mapping system.
Location: Wayne State University
Responsible PI(s): Arif Hasan
Shared Access: YES

Polytec PSV-500 + IR Head (PSV I-550)
Description: SLDV with infrared head for minimal surface prep.
Location: Dynamic Testing Lab, Applied Research Building, University of Arizona
Responsible PI(s): Samy Missoum / UArizona Space Institute
Shared Access: YES (use may be subject to a fee)

Polytec PSV-500
Description: Standard full-field laser vibrometer.
Location: University of Colorado Boulder
Responsible PI(s): Massimo Ruzzene
Shared Access: YES

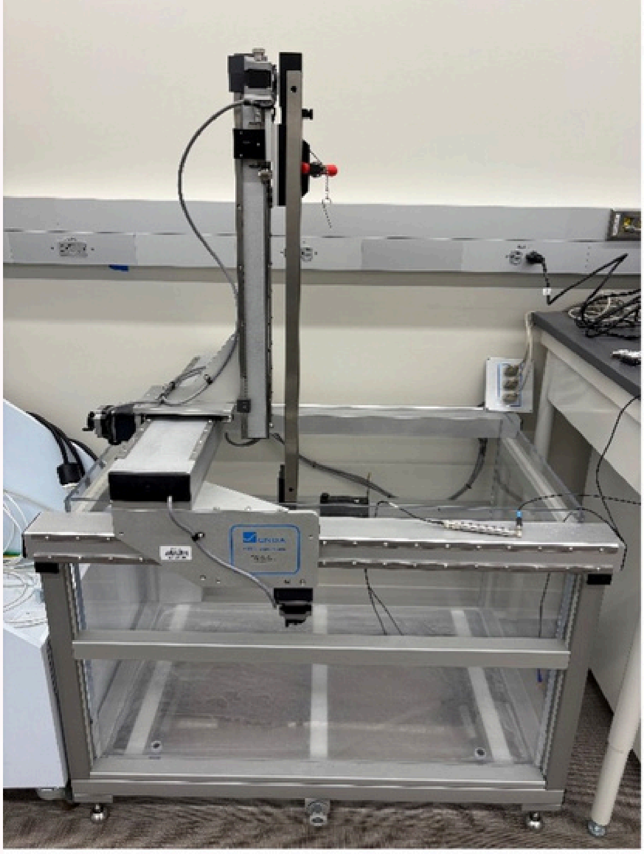
For use of Polytec devices from academic partners senior personnel, please contact Araceli Hernández-Granados at aracelihg@arizona.edu.

VIBRATIONS & ACOUSTIC SENSING

AIMS III Hydrophone Scanning System

Description

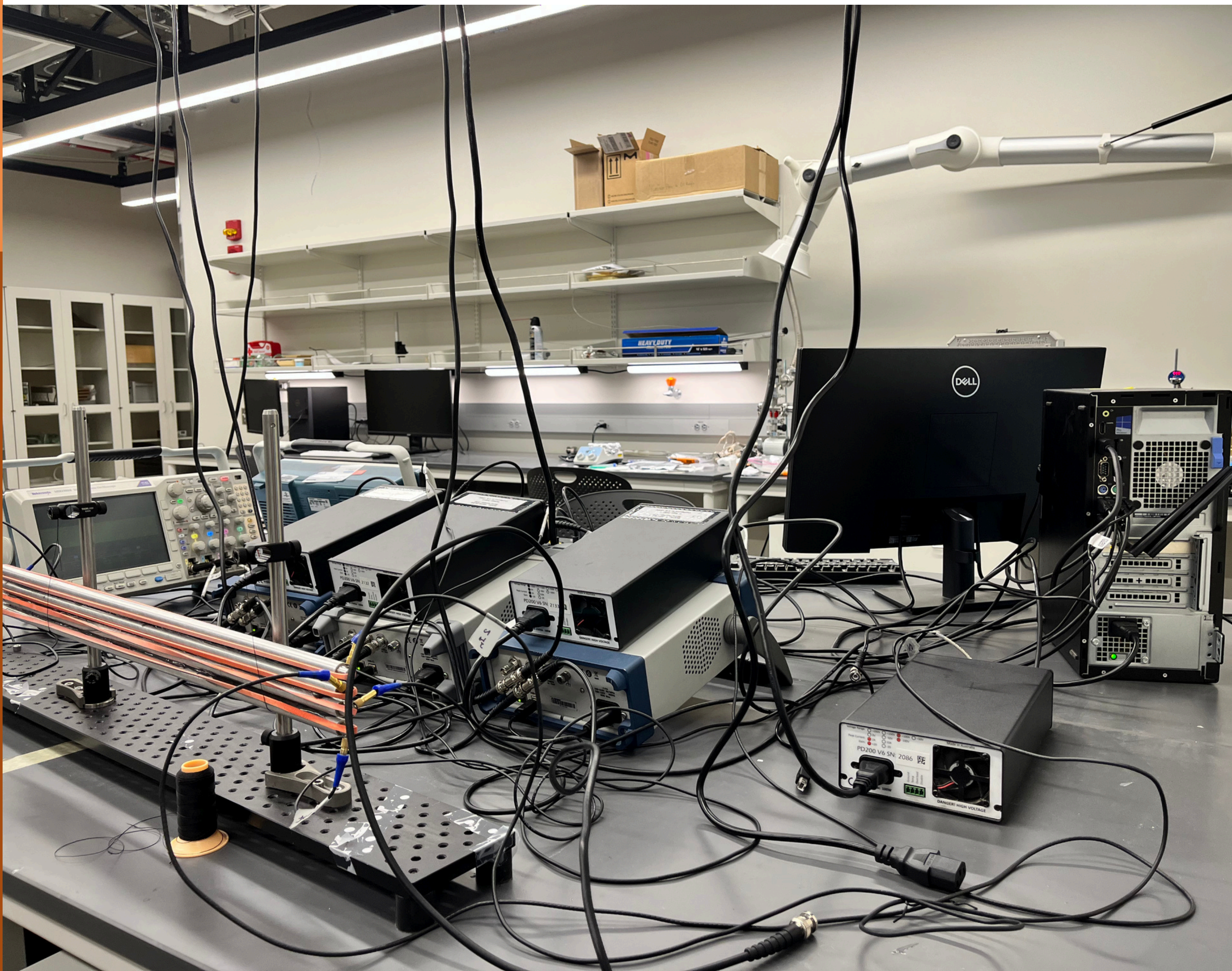
The AIMS III hydrophone scanning system offers enhanced measurement productivity to characterize the acoustic field and vibration of target remotely under the water. The system combines an accurate positioning system, Soniq software, an EMDS motion controller offering 3-axis motion, digital oscilloscope, and an Onda hydrophone to provide the most complete acoustic measurement solution as well as the following visualization. The system also adapts to various temperature and different transducers applied through the calibration function within the embedded software. Potential applications include environmental monitoring such as underwater perturbation and contactless structural health monitoring (SHM).



Location: Deymier Lab, University of Arizona
Responsible PI(s): Pierre Deymier, Ho I-Ting (Andy)
Shared Access: YES

NEW FRONTIERS OF SOUND

Related equipment at the University of Arizona available for NewFoS project

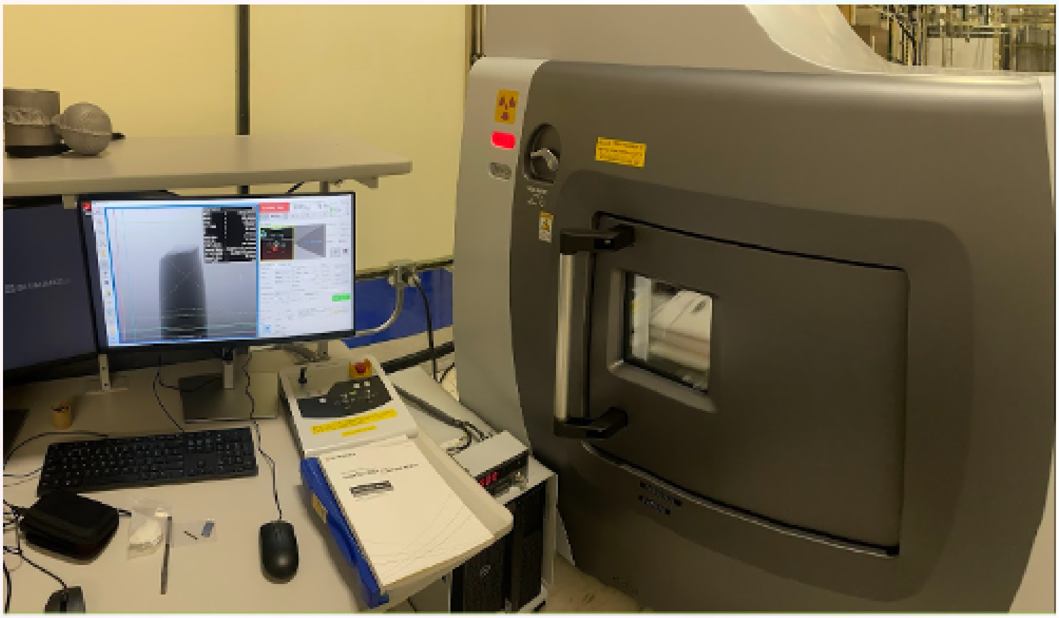


RELATED

Shimadzu InspeXio™ SMX™-225CT FPD HR Plus Microfocus X-ray computed tomography (XCT)

Description

Microstructural details inspected by non-linear acoustical methods can be validated by 3-D visualization through the Microfocus X-ray CT at the Department of Materials Science, the University of Arizona. The inspection target (sample) is placed between the X-ray generator and a large high-resolution flat panel detector. Then, the sample is rotated 360 degrees to collect X-ray fluoroscopic data from various angles in order to calculate cross-sectional images. Due to different X-rays attenuation coefficients, the features that induce non-linearity can be visualize for further quantifications. The resolution limit in terms of voxel size can approach as low as 4 μm, so fine features such as small defects or cracks can be visualized too. The equipment is applicable for researching, developing, or inspecting a wide variety of samples, from ceramics, composite materials such as glass fiber reinforced plastic (GFRP), to metallic components made of conventional cast & wrought or additive manufacturing.



Location: University of Arizona
Responsible PI(s): Ho I-Ting (Andy)
Shared Access: YES

Frequently Asked Questions (FAQ)

What kind of equipment is available through NewFoS?

NewFoS supports access to a wide range of scientific equipment, including:

- Thermal analysis systems (e.g., DSC, TGA, STA)
- Laser Doppler vibrometers (LDV/SLDV)
- 3D acoustic and vibration analyzers
- Spectroscopic tools (e.g., FTIR)
- Glove boxes, furnaces, vacuum systems
- Fiber drawing towers, polishing systems, ball mills
- Advanced imaging (e.g., Microfocus XCT)

Each item is listed with details on its location, responsible PI, and whether it's available for network-wide use.

Who can request access to equipment?

Any NewFoS-affiliated student, researcher, or collaborator from one of the nine participating institutions can request access, as long as the responsible PI has agreed to make the instrument available.

How far in advance should I request access?
We require that all equipment access requests be submitted at least two months in advance. This ensures time for scheduling, coordination with the PI or lab manager, travel planning (if needed), and training.

Do I need to travel to use the equipment?
It depends. Some equipment may allow for remote data collection or collaborative use, while others require on-site presence. This will be determined during your request and follow-up with the host lab.

How do I submit a request?
Please **send out an email to the lab manager** specifying:

- The equipment you wish to use
- Your affiliation and PI
- Your project context
- Dates and duration
- Whether you need training or will travel

Your request will be reviewed by the responsible PI, and you'll receive a response within 1–2 weeks.

Frequently Asked Questions (FAQ)

I've never used this equipment before. Can I still request access?
Yes! In your email, indicate that you will need training. Many NewFoS labs are willing to provide training or pair you with a local collaborator or postdoc.

What if I only need help analyzing a sample or dataset?
When sending your request via the equipment email, please describe your needs as a collaborative service or data-only support. In some cases, local staff may be able to run your sample and share the results if your presence is not required.

Is my data secure and private?
Yes. Any data generated during your use of NewFoS facilities remains under your project ownership, unless otherwise agreed. If you are contributing to a joint publication or repository, that will be coordinated separately.

How should I acknowledge NewFoS equipment in publications?
Please include the following acknowledgement (or similar), when relevant:
"This research used equipment supported by the NSF STC New Frontiers of Sound Science and Technology Center (NSF Award #2243160)."

Are there any costs associated with equipment use?
Most equipment is available at no cost to NewFoS members, unless otherwise noted (e.g., equipment maintained by external centers may charge service fees). If a fee applies, it will be shared with you during the access approval process.

I want to add/remove my equipment to this catalog. How do I do that?
If you are a NewFoS PI or affiliate with equipment you'd like to make available or remove to the network, please contact Araceli Hernández-Granados at aracelihg@arizona.edu
Specifying:

- Equipment name and model
- Description
- Location and PI contact
- Any usage terms or restrictions

Who are the lab managers?
For use of Polytec devices from academic partners senior personnel, please contact Araceli Hernández-Granados at **aracelihg@arizona.edu**.

At the University of Arizona, additional contacts are:

- Dr. I-Ting (Andy) Ho - iho@arizona.edu
- Dr. Wataru Takeda - wtakeda@arizona.edu
- Dr. Pierre Lucas - pierre@arizona.edu
- Dr. Pierre Deymier - deymier@arizona.edu