MATERIALS RESEARCH LABORATORY AT UCSB: AN NSF MRSEC
Shared Experimental Facilities are a cornerstone of the MRL and an enabler of the core research and educational missions of the University.

In expertly staffed, open-access laboratories, students, faculty, and visiting researchers collaborate across disciplinary boundaries every day at the University of California, Santa Barbara.

Through the Materials Research Facilities Network, academic, government, and industrial collaborators regularly make use of MRL instrumentation for their research needs and develop ongoing relationships with MRL staff and researchers.

Your Partner for Materials Characterization

www.mrfn.org
mrfn@mrl.ucsb.edu
The MRL’s Shared Experimental Facilities boast a broad spectrum of capabilities for materials characterization and analysis.

- **Microwave reactors in the Polymer Facility** create controlled conditions for monomer synthesis and polymerizations.
- **The FTIR/Raman Spectrometer** probes chemical bonds and structure in molecular materials.
- **Solar Energy** is simulated in the Energy Facility to evaluate solar cells.
- **Radio**
- **Microwave**
- **Terahertz**
- **Infrared**
- **Ultraviolet**
- **X-ray**

*Nuclear Magnetic Resonance* measurements in the Spectroscopy Facility probe structure, dynamics, and chemical environment of molecules.

The Free Electron Lasers at the Terahertz Facility, an MRL partner, provide the world’s brightest source of tunable radiation from 0.1 THz to 5.0 THz.

The X-Ray and TEMPO Facilities provide diffraction tools for characterizing the structural properties of a wide range of materials.
The comprehensive suites of instrumentation provide techniques to analyze every aspect of a sample’s structure and composition.

- X-Ray Diffraction
- High Performance Computing
- Transmission Electron Microscopy
- Secondary Ion Mass Spectroscopy
- Atom Probe Tomography
- Atomic Force Microscopy
Whether at millimeter, micron, or nano scale, the instruments in the MRL Shared Experimental Facilities investigate internal and external structure.

Unique super-wide bore NMR technique allows rheological imaging of silicone oil under shearing forces.

Length Scale

<table>
<thead>
<tr>
<th>Sub-Å</th>
<th>Å</th>
<th>nm</th>
<th>µm</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer modeling</td>
<td>Atom Probe</td>
<td>TEM</td>
<td>SEM, GPC, DLS, FIB</td>
<td>XRD</td>
</tr>
</tbody>
</table>
At UCSB, materials can be fully characterized, to develop novel properties and new functionalities.
With powerful magnetic fields and variable temperatures, instruments at the MRL reveal the structure, dynamics, reaction state, chemical environment, and magnetic and electronic behavior of materials with high sensitivity.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Magnetic Field</th>
</tr>
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<tbody>
<tr>
<td>2 K</td>
<td>0 T</td>
</tr>
<tr>
<td>4 K</td>
<td>0.7 T</td>
</tr>
<tr>
<td>77 K</td>
<td>5 T</td>
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<td>220 K</td>
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<td>300 K</td>
<td>11.7 T</td>
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<td>373 K</td>
<td>14.1 T</td>
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<td>400 K</td>
<td>18.8 T</td>
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<tr>
<td>473 K</td>
<td>1373 K</td>
</tr>
<tr>
<td>673 K</td>
<td>1773 K</td>
</tr>
</tbody>
</table>

**Temperature and Magnetic Field**

- **Gas Chromatography**
- **Powder XRD, Calorimeter**
- **TGA Mass Spec**
- **EPR Spectrometer**
- **Differential Scanning Calorimeter**
- **SQUID Magnetometer**
- **QD PPMS**
- **300 MHz Imaging NMR**
- **DynaCool PPMS**
- **500 MHz NMR**
- **600 MHz NMR**
- **800 MHz NMR**

The SQUID Magnetometer uses low temperature and strong magnetic fields to detect minute quantities of paramagnetic ions, quantify the number of unpaired electrons and to characterize all kinds of magnetic materials.
The MRL’s Shared Experimental Facilities are constantly expanding and improving to reflect the state of the art, and even to help advance it.

Due to excellent maintenance, management and operation of our Facilities, donations of major equipment are very common.

Donors gain dedicated expert staff to maintain and augment their specialized, high-profile instrumentation, freeing up valuable researcher time, and making their investment available to a wide range of colleagues.

The MRL is proud to share its facilities with academic, government, and industrial users. Please contact us for collaborative opportunities.

www.mrl.ucsb.edu/shared-experimental-facilities
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www.mrfn.org
Your partner for Materials Characterization

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Support for our facilities is provided by the National Science Foundation,
Division of Materials Research

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