

Mission. To support Navy current and future readiness by applying the core science of chemistry.

Unique Features

- Capabilities in optical coatings include the High Target Utilization System (HiTUS). It is one of only two large systems of its kind in the U.S. Facilities include a large, well-equipped clean room, which can be exploited for micro / nanofabrication. HiTUS can deposit uniform coatings at high rates over much larger areas than standard coatings systems.
- Synthetic chemistry laboratories carry out the synthesis, formulation, and characterization of energetic materials.



Combat Support Examples. When a Parachute Deployment Rocket Motor (PDRM) incident threatened to ground the F/A-18 fleet, the Chemistry Laboratory provided rapid data collection and analysis allowing the manufacturer to address and solve the issue in short order. Historically, the chemistry laboratories at China Lake have routinely solved a variety of problems for warfighters during most major conflicts. For example, China Lake developed the chemiluminescent light sticks that addressed warfighter needs of the Vietnam era, and this product is still widely used today in numerous military and commercial applications.

Cost / Time Savings Examples. Calcification prevention tablets developed at this facility resulted in saving the Fleet >\$4M/year in maintenance costs (ongoing). These tablets prevent calcification build-up in sewage systems on ships throughout the Fleet. As major players in the open burn / open detonation permitting process, this allows significant testing capabilities at NAWCWD to be exploited.

RDT&E. Research advances technology that enables the Navy to have a game-changing advantage over any potential enemy. The Weapons Division maintains a state-of-the-art research facility staffed with highly trained scientists who clearly understand military specific technology and Navy needs. The staff routinely provides rapid response capability. Activities include energetic materials and chemistry; novel sensor technology; high temperature composite materials; electrochemistry (including materials development for super capacitors, batteries, and fuel cells); fire suppression; nano science and technology (including novel applications of nano materials for agent defeat applications); organometallic chemistry; renewable and sustainable materials and fuels; chemiluminescence; polymer synthesis and characterization; metamaterials for IR and RF applications; optical waveguides; nonlinear optics; protective coatings; space survivable composites; thin film processing for device applications; molecular modeling; molecular imprinted films (sensors); forensic science (battlefield test kits and advanced fingerprint detection); chemical, thermal, and environmental analysis; continuous emissions monitoring; energetics analysis; materials for domes and window applications; optical coatings; electrochromics; and nanocomposite optics.



Size / Description / Scope. 34,790 SF at China Lake. **Employees:** Chemistry disciplines include organic, inorganic, physical, analytical, energetic, polymer, and materials engineering. **Plant Value:** \$39M+ (Facilities: \$15M, Equipment: \$24M).

Main Facilities

- **Analytical Chemistry Laboratories.** 16,690 SF with equipment valued at \$6M. Located in Michelson Laboratory with clean rooms located separately in the solid state facility.
- **Chemical / Polymer Synthesis Laboratories.** 10,800 SF with equipment valued at \$5M. Facilities can handle small-scale energetics operations (synthesis, testing, and analysis of energetics) 10-g/operation with storage for 1.5 pounds in-house with further magazine storage for 300 pounds.
- **Clean Room Facility.** 4,300 SF class 100. 1,750 SF class 10. Equipment valued at \$6M.
- **Optical Coating Laboratories.** 3,000 SF with equipment valued at \$7M. Additional coating laboratory located in Lauritsen Laboratory with specialized coating equipment staged in standalone dedicated modular clean room facilities.

Instrumentation

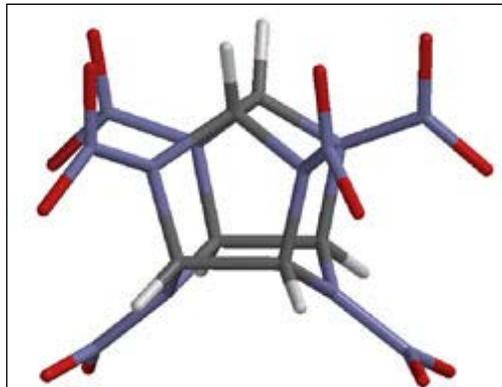
- **Analytical Chemistry.** This includes nuclear magnetic resonance spectroscopy, Fourier-transform infrared (FTIR) spectroscopy, chromatography, mass spectrometry, thermal analysis and inductively coupled plasma spectrometry, X-ray diffraction (powder and single crystal systems).

Optical Coatings

- Physical Vapor Deposition (PVD) Equipment
 - High-density plasma sputter deposition system (30-inch-box coater)—operated in dedicated modular clean room
 - Magnetron-sputter-deposition systems (32-inch, 20-inch) evaporation system
- Plasma-Assisted Chemical-Vapor-Deposition (CVD) Systems
 - One high-density-plasma electron-cyclotron-resonance (ECR) reactor
 - Microwave-assisted CVD reactors (for bulk and doped diamond)

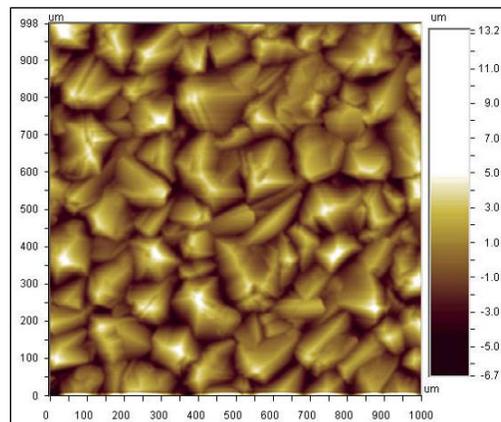
Optical Metrology

- Variable angle spectroscopic ellipsometers
- Ultraviolet (UV)-visible (VIS)-near infrared (NIR) spectrophotometers
- FTIR spectrophotometers
- Precision absolute reflectometer
- Equipment to measure reflectivity / loss
- Surface profilometers
- Confocal laser scanning microscope
- Variable pressure scanning electron microscope
- Four-point-probe measurement of sheet resistance
- Electro-optic-coefficient measurement system
- UV-ozone cleaning system



Nano / Micro Fabrication

- Atomic Force Microscope (AFM)
- Surface profilometer
- Reactive ion etcher with inductively coupled plasma capability
- Spin coater
- Atomic layer deposition
- Electron beam evaporator
- Thermal evaporator
- Langmuir blodgett troughs
- Optical mask aligner
- UV-VIS-NIR spectrophotometer
- Furnaces



Interesting Facts

- Developed CL-20, the most powerful explosive known to date, which represented a giant leap in the field of energetic materials
- Developed space survivable materials tested on the International Space Station with great success
- Developed biofuels derived from butanol and pinenes that show great promise as renewable high performing fuels

Recognition / Awards. Staff member recognized by the American Chemical Society for contributions to Chemistry Education. Researchers regularly publish in peer-reviewed literature and present at national and international scientific meetings. Many patents awarded.