MSD

Materials Science

Advancing the Science and Technology of Materials

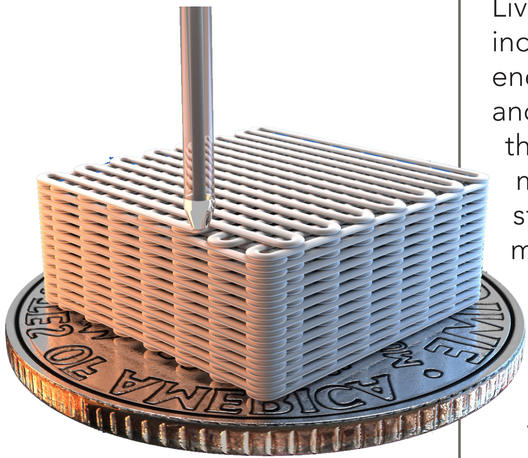
As a leading materials research laboratory, Lawrence Livermore National Laboratory (LLNL) advances fundamental and leading-edge materials science central to our research endeavors. Every day our multidisciplinary materials science teams strive to create novel materials for security and energy applications and to understand the properties and performance of materials subjected to mission-relevant conditions. We use state-of-the-art characterization technologies coupled with modeling and simulation to meet current and future national security needs. Growth areas include metallurgy, material corrosion and degradation, nanomaterials and assembly, advanced manufactured materials, and computational materials science. From actinides and architected materials to polymers and energetic materials, LLNL's Materials Science Division is constantly innovating in materials science.

Everything we do supports Laboratory missions in:

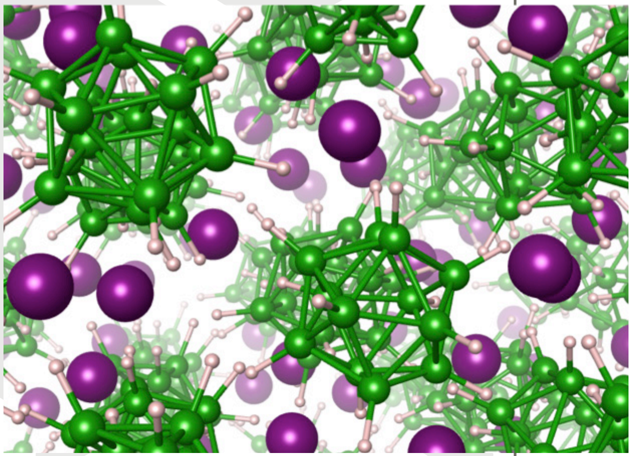
- Nuclear security
- International and domestic security
- Energy and environmental security
- Applied science
- Engineering
- Computing

DEVELOPING NEW FEEDSTOCKS FOR ADDITIVE MANUFACTURING

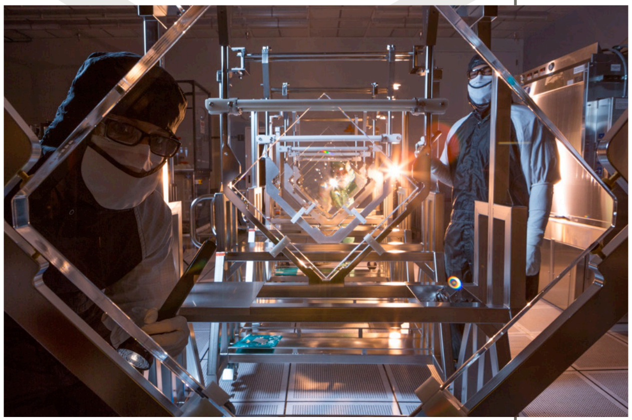
LLNL has emerged as a leader in additive manufacturing technology among Department of Energy laboratories. Understanding how materials behave in various conditions drives our scientists to develop the next generation of flexible materials for diverse applications. We also improve three-dimensional printing, machining, and customization methods in collaboration with Livermore engineers. Our advancements in ink technology include aerogels suitable for battery electrodes and other energy applications, as well as incorporation of nanomaterials and biocatalysts for energy and biomedical uses. Combining three-dimensional printing and subsequent folding (via origami methods) with conductive smart materials to build complex structures is another way LLNL explores the potential of additive manufacturing.



A graphene aerogel microlattice with an engineered architecture is generated via a 3D-printing technique known as direct ink writing.



Simulation of an intermediate phase formed during a solid-state reaction occurring within a magnesium borohydride hydrogen storage material.



Wedged focus lenses and grating debris shields for the National Ignition Facility are processed in LLNL's Optics Processing Facility.

PREDICTING MATERIALS PROPERTIES AND FUNCTION

Home to some of the world's most powerful supercomputers, LLNL is a leader in predictive modeling and simulation of materials and complex interfaces. Our experts build versatile, massively parallel computing capabilities for investigating chemical, electronic, structural, and kinetic properties of materials. These tools address critical challenges in clean energy, nuclear nonproliferation, and extreme-condition science. LLNL belongs to the DOE Energy Materials Network, the Hydrogen Storage Materials Advanced Research Consortium, HydroGEN Advanced Water Splitting Materials Consortium, and Lightweight Materials Consortium. LLNL also directs modeling activities within the DOE Critical Materials Institute and through the hpc4mfg program.

INVESTIGATING EXTREME CONDITIONS

At LLNL we investigate materials subjected to extreme conditions, such as those found in explosions, detonating nuclear weapons, laser fusion, meteorite impacts, or the hearts of stars and planets. Our energetic materials researchers combine breakthrough computer simulation codes, state-of-the-art experimental diagnostics, and a culture in which theory- and experiment-based chemists and physicists collaborate. Along with powerful, versatile technologies, these capabilities enable us to provide a detailed understanding of energetic materials in support of national security missions—particularly in research and development for advanced conventional weapons, rocket and gun propellants, and homeland security, demilitarization, and industrial applications.

REFINING OPTICAL MATERIALS

LLNL develops and qualifies new optical materials and laser-based material processing techniques for optics in high energy and high power laser systems. Our scientists continually refine the development, processing, finishing, and characterization of optical materials. Research in laser–matter interactions includes laser damage physics, optical fabrication, laser and chemical post-processing, and additive manufacturing. In addition, our scientists develop novel materials and precision assembly techniques for advanced targets for the National Ignition Facility.

Lawrence Livermore National Laboratory is operated by Lawrence Livermore National Security, LLC, for the U.S. Department of Energy, National Nuclear Security Administration under Contract DE-AC52-07NA27344. LLNL-BR-733463

Lawrence Livermore National Laboratory **llnl.gov**
Materials Science Division **pls.llnl.gov/msd**
msdrecruiting@llnl.gov