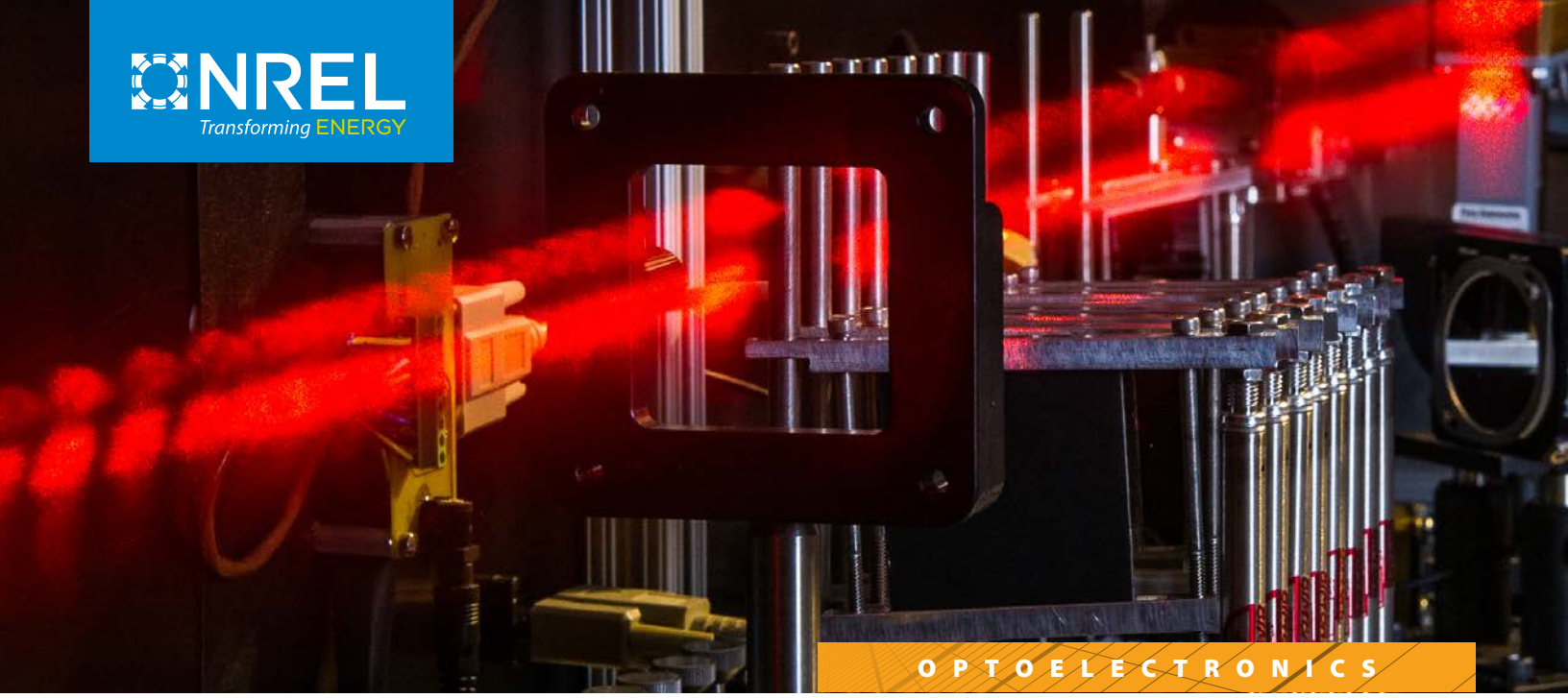

Photo by Dennis Schroeder, NREL 35789

Advancing the Science of Materials That Interact With Light and Electricity

We take a comprehensive approach to developing next-generation materials by combining deep expertise in materials discovery, selection, synthesis, characterization, and reliability testing. The result? A national-laboratory-scale team and a suite of capabilities that can deliver scientific understanding and technical solutions tailored to meet your R&D needs.

Scientific Foundation for Innovation in Material Development

Advances in materials play an integral role in developing new and improved optoelectronic devices—technologies that use, detect, create, or control light and electricity. NREL's expertise in foundational materials science for solar cells can be leveraged to advance optoelectronic materials for many other applications, including high-performance solid-state lighting, lasers, next-generation microelectronics, infrared photodetectors, optical transformers, light-detection and ranging systems, sensing, optical and material coatings, and power electronics.

Why Partner with NREL?

NREL scientists have worked with academic and private-sector partners to develop materials for a range of applications:

- **A passivating layer for improved laser diodes that helps direct more energy to the laser instead of losing it as heat**
- **Wide-bandgap semiconductors such as silicon carbide, gallium oxide, and other materials for advanced power electronics**
- **Materials for dynamic windows that transmit light when clear and produce power when opaque**
- **Perovskite materials for non-photovoltaic applications, such as LEDs and photocatalysis.**

Comprehensive Approach for Impact

By leveraging our legacy work in materials science, NREL solves a broad array of materials-based problems. Our holistic approach features a stepwise process underpinned by analysis that provides feedback to ensure R&D is impactful and relevant. Our ultimate strategy is to move technological advances from the lab to the marketplace—all with a focus on quality and efficiency.

- We **apply our expertise** in semiconductors, nanomaterials, electrical contacts, encapsulants, and optical coatings to broader science on the interaction of materials with light and electricity.
- We **identify and select materials** for optoelectronic device layers, including substrates, light absorbers and emitters, electron transport and barriers, optical coatings, and passivation layers and contacts.
- We **optimize material synthesis**, including surface preparation, epitaxial growth conditions, nanocrystalline and polycrystalline parameters, and structural phase and composition control.
- We **integrate materials**, including the design of metamorphic buffers for lattice-mismatched growth and the characterization and design of interfaces.
- We **determine performance-limiting factors**, including defects and stability and degradation mechanisms, from the macro to the atomic scale.

Partner With Us

We have multiple options for partnering, including the licensing of NREL intellectual property; agreements for performing specific technical work, such as measurements or analysis; and cooperative R&D agreements for working jointly on projects.

Snapshot of NREL.
The National Renewable Energy Laboratory is transforming energy through research, development, commercialization, and deployment of renewable energy and energy efficiency technologies.

- **Technologies for Licensing:** 645 patents issued for NREL technologies to date
- **Partnerships:** nearly 900—with industry, universities, foundations, and governments
- **R&D 100 Awards:** 71
- **Business Volume:** $599.4 million
- **Employment:** 2,700 —employees, postdocs, interns, visiting professors, subcontractors
- **Collaborative Research Facilities:** Include Solar Energy Research Facility, Science & Technology Facility, Outdoor Test Facility, Energy Systems Integration Facility

Contact Us

Technical
Kirstin Alberi
Kirstin.Alberi@nrel.gov
303-384-7647

Partnerships
Steve Gorin
Stephen.gorin@nrel.gov
303-384-6216

A Formal Approach to Technology Development and Commercialization

Scientific Understanding

- Wide-bandgap semiconductors
- Passivating, thermoelectric, topological, phase-change, insulation, ceramic materials
- Process science/materials by design
- Computational modeling
- Quantum info processing

Synthesis

- Epitaxy and thin-film deposition
- Coatings and passivation layers
- Heterostructures

Technologies

- Multilayer chip capacitors
- Light emitters
- Electronics
- Sensors and detectors
- Transparent conductors
- Diodes
- Quantum light sources
- Spintronics
- Dynamic windows
- Solid-state refrigerants

Characterization

- Optical spectroscopy
- Electron microscopy
- Surface analysis
- Chemical analysis
- Electron transport
- Thermal transport

Reliability and Bankability

- Reliable system performance
- Techno-economic analysis
- Life-cycle assessments

NREL Transforming ENERGY

National Renewable Energy Laboratory
15013 Denver West Parkway
Golden, CO 80401
303-275-3000 • www.nrel.gov

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

June 2022 • NREL/FS-5F00-76980