

Technology Initiatives

The Nuclear Engineering (NE) Division carries out research and development on laser-based applications for materials processing and aerosol or spray characterization. Computer simulation and robot task programming tools are employed to enhance the safety and efficiency of telerobotics in the decontamination and decommissioning of nuclear power plants. Currently, we are exploring opportunities in laser drilling of oil and gas wells, advanced robotics, and high power laser applications.



Laser Applications

The Laser Applications Laboratory (LAL) carries out research and development on laser-based applications for materials processing and aerosol or spray characterization. Collaborative research and development activities with industrial partners are a key activity. The LAL's integrated approach maximizes the synergy between laser/beam-delivery manufacturers and developers/users of the technology.

The LAL facility houses two high-power industrial laser systems, complete with diagnostics for materials-processing functions: a 6 kW CO₂ laser and a 1.6 kW pulsed Nd:YAG laser. The equipment was provided by a \$1.7 million grant from the State of Illinois for Argonne and its industrial partners to develop advanced materials-processing methods. Capabilities include cladding, cutting, drilling, surface modification (heat treating, glazing, surface alloying), welding, process monitoring, and laser thermal simulation studies.

The general goal of the laser processing effort is to optimize laser processing parameters for materials-processing functions on the factory floor. More specialized goals include development and optimization of industrially robust beam-delivery systems for specific processing needs.

Projects with industrial partners

LAL projects are structured to be synergistic and complementary. Improvements in laser beam delivery, power measurement, and sensors for on-line process monitoring will positively affect the viability and cost-effectiveness of high-power laser processing technology that is currently used in automotive and other manufacturing sectors. Ongoing LAL projects with industrial partners include:

- *Laser Oil and Gas Well Drilling and completion* – Using high-power lasers to drill and complete gas & oil wells
- *Laser Heat Treatment* – Optimization of laser beam heat treatment (Caterpillar and USCAR)
- *Laser Welding of Metals* – High-speed laser welding of stainless steels for automobile exhaust systems (Delphi Energy and Engine Management Systems)
- *On-Line Monitoring* – On-line process monitoring for laser-beam welding (USCAR)
- *Laser Beam Delivery* – Fiber-optic beam delivery for high-power Nd:YAG lasers (U.S. Laser)
- *Laser Glazing of Railroad Rails* – Laser glazing of railroad rails (American Association of Railroads)

Other Projects

In addition to its collaborative activities with industrial partners, LAL carries out DOE sponsored research and development on high power laser materials processing:

- *High Power Laser Beam Delivery* – High-power laser-beam delivery with conventional and fiber optics
- *Decontamination & Decommissioning* – Laser processing technology for decontamination of surfaces
- *Refractory Alloy Welding* – Welding of refractory metals such as vanadium alloys

For additional information, please visit
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