

# SCALE-UP, DOWN TO A SCIENCE

*Bridging the gap between research and manufacturing*



- Expert staff with decades of industry experience
- World-class facilities for materials scale-up R&D
- Powerful tools for imaging and characterization
- High-performance computing and artificial intelligence
- Life-cycle and techno-economic assessments

Argonne's expertise in innovative materials and industrial process development helps transform cutting-edge discoveries into commercially promising technologies.

## SCALE-UP, DOWN TO A SCIENCE

At the U.S. Department of Energy's (DOE) Argonne National Laboratory, partners have access to a rare concentration of experts and world-class facilities. By working with Argonne, public- and private-sector partners can rapidly develop and scale up materials discovered at the laboratory bench (gram-scale) to commercially relevant quantities produced using a cost-effective, scalable process (kilogram-scale).

At the Materials Engineering Research Facility (MERF), a world-class, 28,000-square-foot process R&D and scale-up facility, Argonne unlocks the potential of promising materials with a suite of conventional and innovative process technologies and

a track record of delivering impact for its partners. At the MERF, Argonne engineers and scientists:

- Develop economically viable processes for manufacturing materials at scale, supported by techno-economic assessment
- Test the feasibility of making kilogram quantities of innovative materials
- Distribute samples for industrial evaluation, prototyping, and further research

Argonne's national scientific user facilities, supported by DOE's Office of Science, offer deep insights into materials and process technologies not available in most industry R&D labs. The Advanced Photon Source, one of the most advanced X-ray

light sources in the world, and the Center for Nanoscale Materials, where scientists explore the frontiers of nanotechnology, enable the visualization and manipulation of microscopic defects and process dynamics at high resolution.

The Argonne Leadership Computing Facility (ALCF), which will soon be home to the nation's most powerful exascale computer, harnesses high-performance simulations, data analysis, and artificial intelligence for additional insight beyond the reach of experiments. Combined, these capabilities position innovative materials and manufacturing processes for commercialization.

**SUPPORTING MANUFACTURERS,  
LARGE AND SMALL**

As DOE's largest national laboratory in the Midwest, Argonne is positioned at the heart of the U.S. manufacturing sector. It works with dozens of companies, from Fortune 500 leaders and smaller specialty businesses to start-up companies embedded at the laboratory, to advance U.S. leadership in materials manufacturing. With support from DOE and other federal agencies, Argonne has accumulated a substantial portfolio of intellectual property available for licensing or collaborative development.

**A VIRTUOUS CYCLE  
SHORTENS TIME TO MARKET**

The demand for a clean energy economy is intensifying the pace of bringing new materials to market. Argonne's unique combination of innovative manufacturing process technologies, in-line characterization tools and advanced computing resources enables its partners to learn rapidly how process inputs correlate to material outputs. The integration of high-performance simulations and artificial intelligence reduces trial-and-error and creates a virtuous cycle that helps mature technologies faster, even including autonomous experiments. In short, Argonne has scale-up down to a science.

Argonne's researchers have worked with more than 60 companies during the past 10 years to accelerate the scale-up of their most challenging materials, chemistries and processes, helping to drive innovative products to the market faster.

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