Idaho National Laboratory scientific glass blower Russel Lewis has been making specialty glassware for INL scientists for a decade.

The science and art of shaping glass

By Mike Wall, *INL Communications & Governmental Affairs*

The scene is surreal: A figure, his face obscured by a wide reflective eyeshield, stands over a spinning transparent tube the size of a baseball bat. A length of tan elastic hose dangles from his mouth. He lowers a hissing torch to the cylinder's surface and the entire tube blazes up, white-hot and brilliant under the fluorescent lights.

But this is no futuristic foundry. It's just another day at the office for the man behind the mask, Idaho National Laboratory scientific glassblower Russel Lewis. For the past decade, Lewis has been designing and building much of the glassware INL researchers use in their experiments. The work is a true blend of science and art, and Lewis loves it.

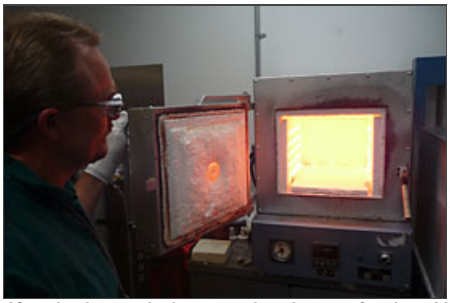
"It's something new every day," he says. "It never gets boring around here."

Click above to hear a podcast with Lewis, or read the transcript.

Getting past the finger-burning stage

Lewis got into glassblowing in 1987. He was a pipefitter back then, and he began playing around with glass in his garage to kill time.

"I started out just melting pop bottles," he says. "It was so fascinating that I decided, Well, I might as well jump into it."



After shaping, each piece goes into the oven for about 20 minutes.

Lewis bought some equipment, checked a few books out of the library and began experimenting. The learning curve was steep, and a little painful.

"It was tough at the beginning," he says. "It took patience, because there was a lot of disappointment. But once you get past the finger-burning stage, then it starts to be a lot of fun."

Lewis persevered, getting better and better. Ten years ago, he signed on as INL's scientific glassblower, becoming a member of a pretty exclusive guild. He estimates there are only about 430 of his kind nationwide. And he's the only glassblower at INL, so he stays plenty busy.

Turning glass into gear

Big companies like Corning manufacture much of the glassware found in chemistry labs — the standard beakers, flasks and test tubes. But INL scientists frequently need nonstandard equipment, pieces built to suit specific experiments. That's when they come to Lewis, often with little more than an idea.

"They'll give me their concept," he says. "I usually have to figure out how to make it work."

One of Lewis' first decisions is which type of material to use. He has two main choices: quartz and borosilicate. Borosilicate can be easier to work with; it heats up faster and takes less energy to shape. Most standard labware is made of the stuff. But quartz is more resistant to thermal shock, allowing use up to 1,050 degrees Celsius, and it's more acid-resistant than borosilicate. INL researchers are doing so much high-temperature work, Lewis says, that he usually opts for quartz.

The next step for Lewis is to take his raw materials — hollow tubes of varying length and thickness — to the lathe. As the lathe spins the tubes around, Lewis applies his torch to soften up the glass. He can bend and twist the tubes and lock different pieces together. And using that elastic hose in his mouth, Lewis can puff sections out into bells or collapse them down.

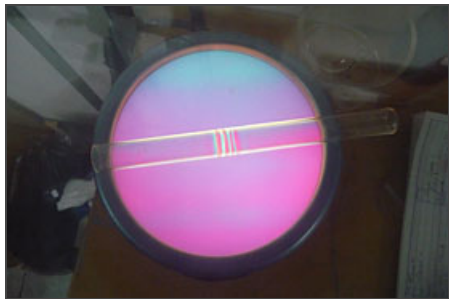
This part of the work can take a few hours or a few days, depending on the piece's complexity. A while back, an INL researcher asked Lewis to make something that would help two fluids mix in a high-radiation field. Lewis took a bunch of skinny tubes — each four feet long and three-eighths of

an inch wide — coiled them up and connected them together. He ended up with 75 feet of tubing coiled in a piece the size of a coffee can. It took him about a week. Then he made five more.

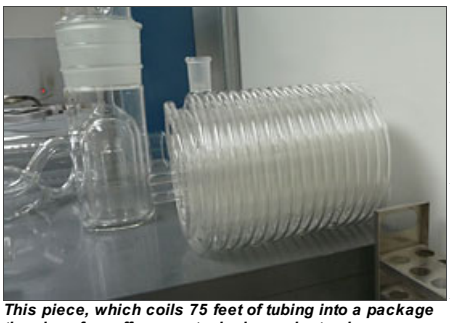
"That was definitely a challenge," Lewis says.

After the shaping's done, one more step remains: each piece goes into an oven for 20 minutes or so. Quartz gets cooked at 1,100 degrees Celsius, borosilicate at 570. Once removed, pieces are allowed to cool slowly. This process, called annealing, relieves internal stresses in the glass, making it more durable.

"Everything gets annealed," Lewis says. "The ovens never really get cold."



Oven treatment helps clear glass of stress lines (visible here through a polariscope).



This piece, which coils 75 feet of tubing into a package the size of a coffee can, took six weeks to shape.

The artistic side

Glassblowing is more than a job for Lewis; it's also a hobby and a creative outlet. He spends a lot of time in his home workshop, firing up his torches in the evenings and on weekends. But these efforts are strictly artistic. He sculpts solid glass, turning it by hand rather than with a lathe.

And after all these years, Lewis has no plans to slow down, either at work or at home.

"I'm hooked," he says. "Working with glass is so mesmerizing."

Additional Information:

Watch a video interview with Lewis.

See a news feature about Lewis and his work.

Feature Archive