



# Tom Nizolek: Hobby-machinist and metallurgist

February 23, 2021

## Employee Spotlight

Thomas Nizolek of LANL's Finishing Manufacturing Science group strolls into his sunroom, safety glasses at the ready. Rather than the usual tables, chairs and other furniture typically found in such places, this room looks more like something out of a machine shop, with industrial-grade equipment rivaling anything a steampunk designer could come up with. This rather unusual collection amounts to what Tom calls his “tools of the trade,” the bulk of which he repaired and restored himself.

“Bulk” takes on new meaning when it comes to this shop, as collectively the machines here weigh tens of thousands of pounds. Tom readily admits that his collection has gotten out of hand, but without these machines and supplemental equipment he could not feed his passion of studying, creating and working with all kinds of metals.

“I would imagine a music professor would likely play more than one instrument as a hobby,” explains Tom. “Likewise, as a materials-science R&D engineer whose focus is metallurgy, I enjoy working with metals as a hobby. Yet this requires some fairly extreme equipment, as metals can be tough, hard and melt at very high temperatures—making them difficult to shape, form or cast. My machines are necessary tools for creating, studying and using metals and their alloys.”

### A passion for materials science

As a kid, Tom enjoyed watching his grandfather, a retired General Motors machinist, make anything he needed from scratch.

“Rather than go out and buy a part for his motorboat, he would just go into his basement shop and make one,” says Tom. “Watching him work, I appreciated the skill and inventiveness needed for metalworking, and that’s what got me into casting bronze and using blacksmithing to forge all types of tools, including pattern-welded blades (commonly known as Damascus steel blades).”

As Tom progressed in his metalwork, he soon began to appreciate the science behind materials.

“My early work was filled with failures—without an understanding of phase transformations and the mechanics of materials, I would make a sword that was beautiful, but it would end up breaking into three pieces,” says Tom.

As the focus of his hobbies became increasingly technical, Tom began to explore precision machining (creating precise components made from metals and alloys), metrology (taking accurate measurements for customized metal parts) and metallography (studying the physical structure and components of metals).

“The challenges and questions I encountered in my hobby really motivated me to study materials science in college, which in turn continued to fuel my hobby of metallurgy,” says Tom. “There’s a whole world of complexity that you must understand when it comes to metallurgy and the mechanical behavior of materials—attempts to make intricate tools or devices without also focusing on the intricacies of the material itself are bound to fail. The more challenging the piece you have in mind, the more you must take materials science and engineering principles into consideration when crafting it.”

A young Tom Nizolek works on making a blade using a hammer and anvil while a coal forge burns in the background. Tom’s early work included a beautiful pattern-welded blade (top right) made in part with nickel alloy taken from a meteorite. Later work, such as a wine bottle opener (bottom right) made for his graduate advisor, continued to make use of exotic materials (the corkscrew was machined from a single-crystal superalloy).

## **Old but wonderful machines**

Tom Nizolek uses a refurbished wire electric discharge machine on a block of metal. This machine uses high-voltage sparks to make precise cuts through even the hardest materials, such as high-speed steel and tungsten carbide.

As Tom delved into metallurgy, he realized he needed specialized machines to carry out his hobby.

“Peculiar hobbies like precision machining and metrology require some esoteric, industrial-grade machines that admittedly are prohibitively expensive, so what I began to do was purchase older, usually broken machines that I would repair and restore to their former glory,” he says. “These machines enable me to perform highly detailed work on certain parts. So, worrying about a tenth of an inch when it comes to forging a knife progressed to worrying about creating a part with a precision of less than a thousandth of an inch.”

By “older,” Tom means that his restored machines range in age from the late 1800s to a few machines that are only about 25 years old. He has as many as 12 large machines in his shop, as well as auxiliary equipment, such as heat-treating furnaces.

“As you can imagine, machines that go back to the 1940s and 1950s have taken their share of wear and tear, and some parts have to be repaired or replaced,” says Tom. “Refurbishing these machines gives me great satisfaction, but it is this part of my hobby that also enables me to have some incredible machines, such as the wire electric discharge machine, a recent acquisition. Since this machine cuts metal by using millions of electrical discharges (highly controlled sparks), it is ideal for cutting intricate contours in difficult-to-machine materials such as tungsten or very hard materials such as high-speed steel.”

Like his grandfather, Tom has the expertise and machinery to build anything that comes to mind.

“It’s really a self-sustaining problem, the ability to craft anything out of metal once I’ve put my mind to it,” Tom chuckles. “The more machines I acquire, the more I need other machines to make new parts for the ones that need restoring. Still, having these machines in my home shop has let me turn the ideas I have in my head into real materials and components that are functional and, in a way, beautiful.”

Although Tom crafts metals mostly for himself, he admits he’s attracted his share of outside interest.

“Before the COVID-19 pandemic, I had a steady stream of friends coming over to have me craft motorcycle parts, boat parts, bicycle parts—those sorts of things,” Tom says. “It’s fun to help others with their projects and it’s exciting to see what new challenges they bring to me. It’s very satisfying.”

Tom Nizolek prepares a metal sample to inspect its microstructure under a microscope. This type of work, known as metallography, enables Tom to verify that the materials he creates or uses have the desired structure and therefore properties.

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