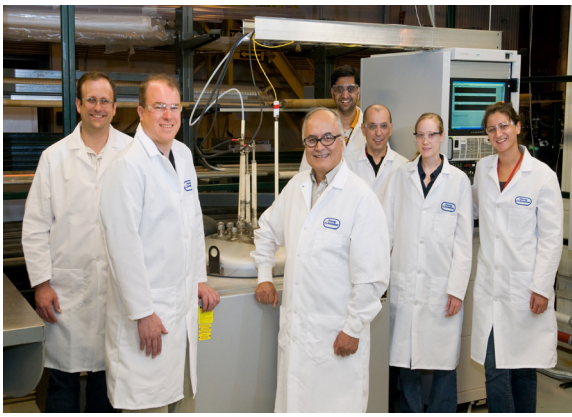
Scaling Up Argonne's Ultrafast Boriding Process

U.S. manufacturers use a variety of heat treatment processes, such as nitriding, carburizing and traditional boriding, to improve the performance and durability of machine tools and other mechanical components. However, these traditional technologies are very time consuming, energy intensive and expensive.



Pictured in front of the pilot-scale ultrafast boriding unit from left – Gregory Krumdick, Craig Zimmerman (industrial partner – Bodycote), Ali Erdemir, Vivekanand Sista, Osman Eryilmaz, Alyssa Skulborstad and Guldem Kartal.

The Challenge

To improve the competitiveness of companies involved in heat and/or surface treatment practices, a more cost-effective, energy-efficient and more environmentally friendly process was needed.

The Solution

Argonne researchers, in collaboration with the Istanbul Technical University and Bodycote, developed a transformational technology called ultrafast boriding. Boriding involves heating materials with boron compounds to convert its surface into an extremely hard compound with superior wear resistance. Compared to existing thermal treatment processes, ultrafast boriding provides much higher energy efficiency, productivity and near-zero emissions.

Researchers Guldem Kartal (left) and Alyssa Skulborstad operate Argonne's pilot-scale ultrafast boriding reactor.

The Results

Ultrafast boriding can complement and possibly displace many of the very energy-intensive surface treatment processes that are in use today. Argonne has successfully borided multiple quantities of industrial parts with a pilot-scale reactor. A commercial-scale system is now in the process of being designed.

"Our ultrafast boriding process will revolutionize the surface engineering and treatment fields by increasing productivity, product quality and reliability and by drastically reducing energy consumption and toxic emissions associated with traditional processes," **said Ali Erdemir, senior metallurgist, Argonne National Laboratory.**