UI research gets more crystal clear

■ X-ray beam gives close look at solids, liquids

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Examine a sheet of steel, and you perceive a smooth surface. But down inside, near the atomic level, are multi-faceted crystalline structures, not unlike the much bigger crystals you can see with your eyes and turn into desk ornaments and chandeliers.

The nature of those microscopic structures is what makes metal strong.

Proteins, which have significant roles in biological processes, also can form crystals. Silicon, the base component of computer chips and other microelectronics, is full of them as well.

A greater understanding of how these tiny crystalline structures form and perform would be useful to everyone from structural biologists to steel makers.

Some University of Illinois scientists have developed a technique that should help. Their solution: Give the microscopic crystals an X-ray.

An X-ray microscope developed by UI researchers can make detailed, three-dimensional images of crystals formed inside both solids and liquids.

"You can find the positions of all the atoms inside," UI physics Professor Ian Robinson said recently. "We're getting additional measurements (than other methods). We're interpreting it more finely."

Robinson developed the microscope with graduate students Garth Williams, Mark Pfeifer and Sebastien Boutet and Ivan Vartanyants, a visiting scientist at the UI, using a high-powered X-ray beam generated at Argonne National Laboratory near Chicago. The National Science Foundation, U.S. Energy Department and state of Illinois funded the work.

The microscope isn't the kind where you peer through an eyepiece at something on a slide of glass below. It's lensless and it creates images on a computer screen using software routines developed by the UI researchers.

The images are formed by interpreting signals from the X-rays and collected with an electronic charge-coupled device similar to those used in digital cameras.

"You shine X-rays in a sample and you collect everything that is scattered, the light that is scattered by the sample,"

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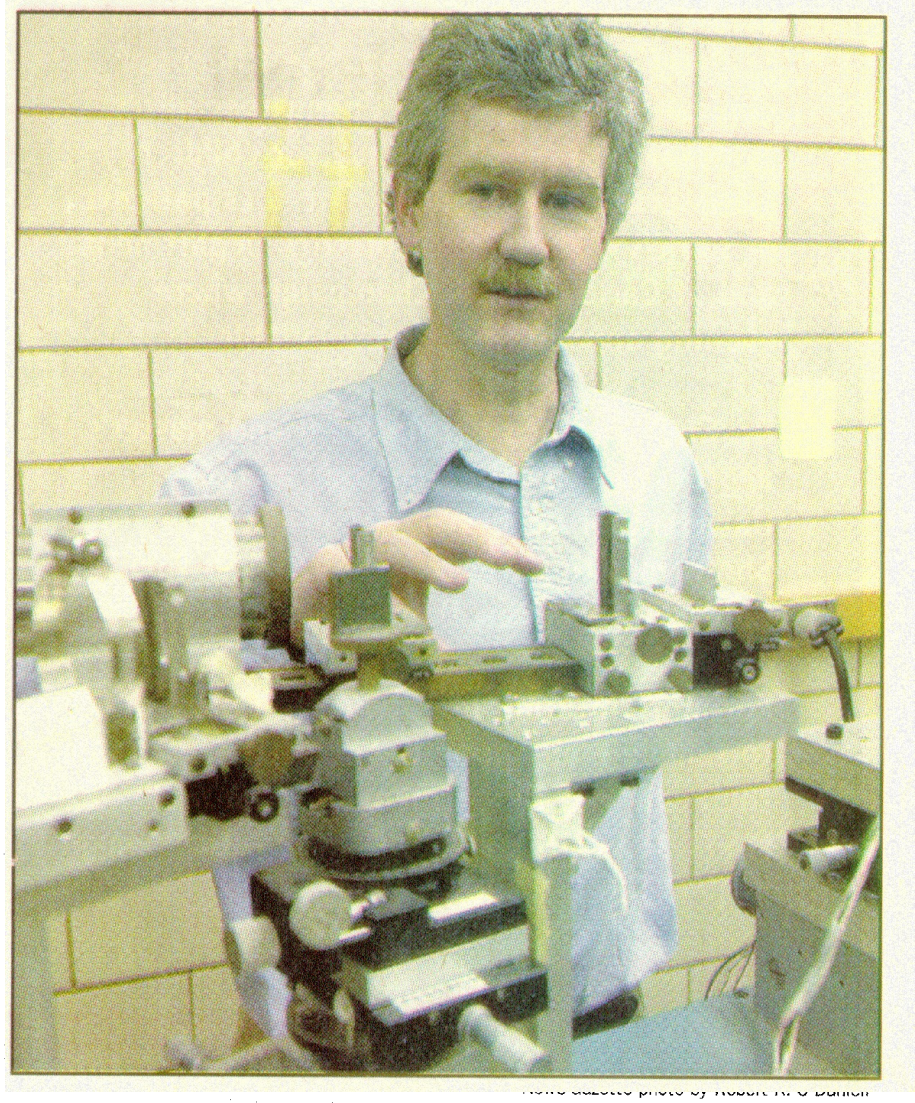

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University of Illinois physics Professor Ian Robinson is using the X-ray microscope to study what happens when metals are cut and when they're ground together in low-temperature milling.