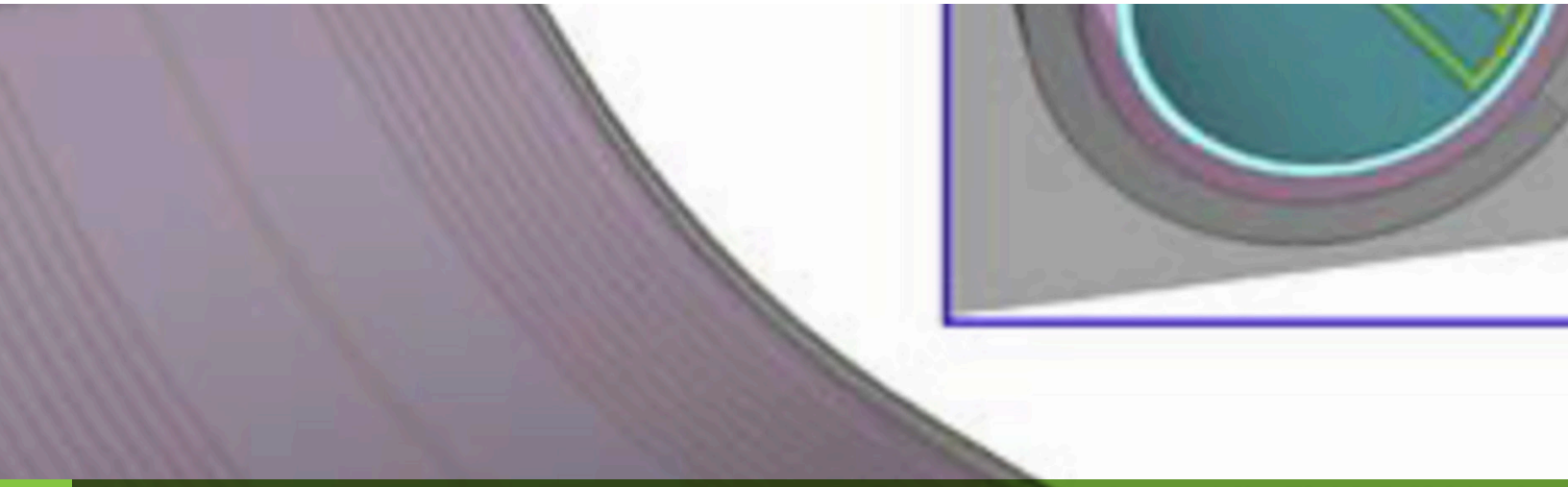
Argonne NATIONAL LABORATORY




# FLEXIBLE BIOSENSORS INSPIRED BY FISH SCALES **COULD YIELD WEARABLE ELECTRONICS**

## THE IMPETUS

Researchers working at the Center for Nanoscale Materials (CNM), a U.S. Department of Energy (DOE) Office of Science user facility located at Argonne National Laboratory, working with CNM users and collaborators from the University of Chicago, the University of Science and Technology in China, Argonne, the University of Southampton in the United Kingdom and Hanyang University in South Korea, constructed active, flexible matrices of three-dimensional calcite that function as an array of growth regeneration sites, modeled after the specialized dynamics of fish scales. Calcite has proven itself a model system for understanding the natural process whereby living organisms produce minerals, often used for structural features like seashells and bones. Each cell in the novel active array could act as a separate growth workshop with different growth functions.

## THE WORK

This work explored applying the mineralized growth to different applications and produced three different dynamic surfaces and interfaces with separate characteristics and potential purposes. The first is a deformable surface with tunable toughness that may open new opportunities in mineral materials from synthesis to device applications. The second uses the calcite microarray to encapsulate a flexible silicon nanowire sensor. The calcite housing could enable a biocompatible sensor that can be grown in ambient conditions. The third creation established a new mechanism for underwater adhesives, in which the mineral growth serves as an inorganic localized adhesion for biological tissues or other surfaces.

Fabrication via optical and focused ion beam lithography of the field effect transistor with mutable calcite plugs occurred at the CNM. X-ray Laue diffraction and transmission X-ray microscopy measurements took place at Argonne's Advanced Photon Source, a DOE Office of Science user facility.

## THE IMPACT

The induced growth of minerals yields localized inorganic adhesion for biological tissue and dynamically reversible focal encapsulation for sensitive components such as those in flexible electronics.

## CONTACT

**Argonne National Laboratory**
9700 South Cass Avenue
Lemont, Illinois 60439
Phone: 630-252-2000
Email: partners@anl.gov
**www.anl.gov**

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