PROTECTING OUR NATURAL WORLD

RECREATING OUTER SPACE TO UNDERSTAND EARTH

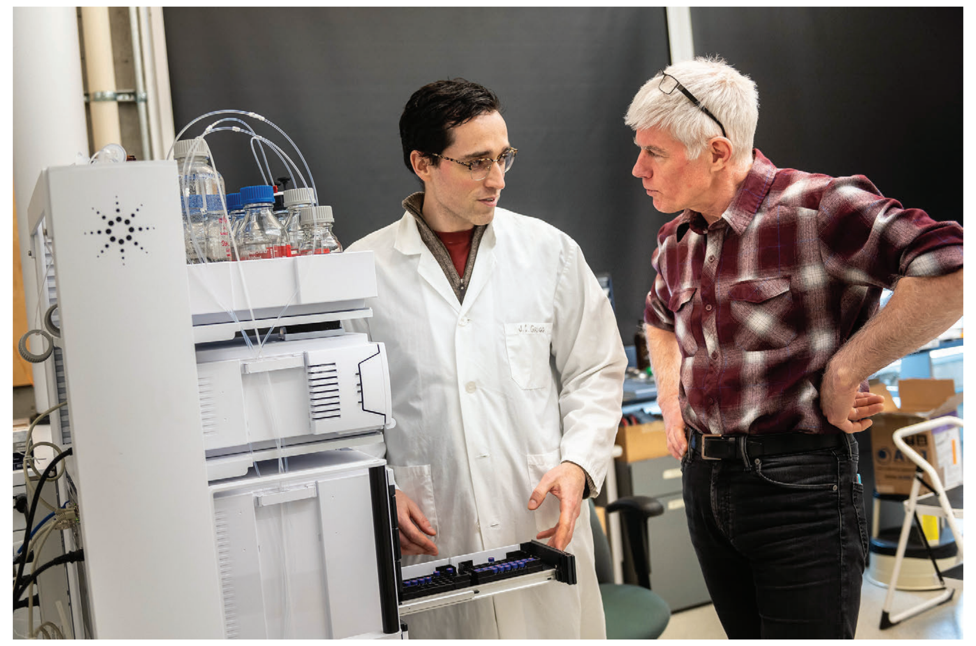
Extreme conditions — severe pressure, intense temperatures, and high levels of radiation— exist all over the Earth and beyond. Scientists from the University of Saskatchewan used the CLS to learn more about how extreme conditions, like the vacuum of outer space, affect how water crystallizes into ice. This research could lead to a better understanding of what happens to water and organic molecules in extreme environments on Earth, like oil and natural gas pipelines operating in cold Canadian winters — ultimately improving their efficacy and reliability.

DOI: 10.1021/acs.jpcc.1c08108

USING CORALS TO UNCOVER OUR OCEANS' PAST AND FUTURE

Researchers from the U.S., Japan, and Canada used the CLS to develop a method for determining past ocean temperatures from cultured corals in the lab. The team found that the composition of potassium isotopes in cultured coral is dependent on seawater temperature. These isotopes can show chemical weathering patterns that influenced the carbon cycle over the past millenia. This tells us how carbon quantities in the ocean have changed over time, and how they may change in the future in relation to changing ocean temperatures.

DOI: 10.1016/j.epsl.2022.117393.



Lindsay Eltis and colleage, UBC

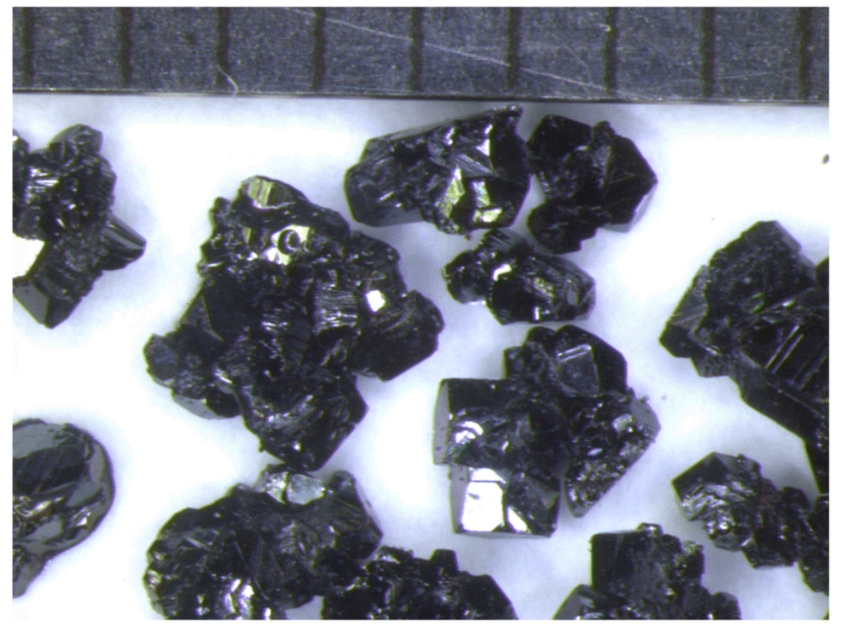
BACTERIA TRANSFORM PAPER INDUSTRY WASTE

Getting more useful products out of renewable resources like wood is the goal of scientists who are using Canada's only synchrotron. Researchers from the University of British Columbia are studying how bacteria transform wood-derived compounds into useful chemicals. Harnessing this process could lead to new, eco-friendly biotechnologies. The researchers used the CLS to study an enzyme that breaks down the ring structures found in lignin, a major component of the woody biomass that is burned by the pulp and paper industry. Using synchrotron technology, the team was able to visualize and describe this enzyme for the first time.

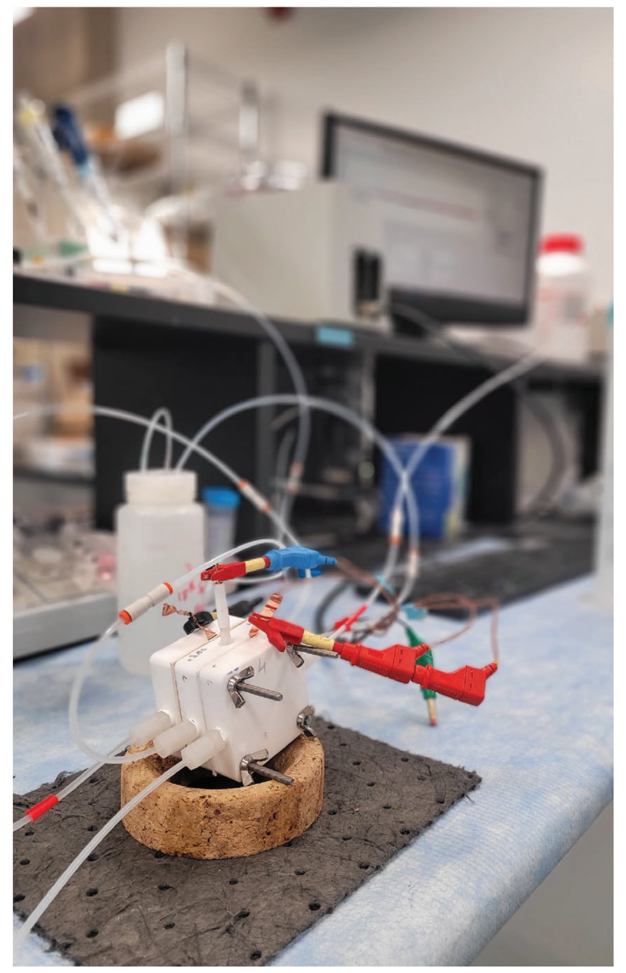
DOI: 10.1016/j.jbc.2022.101871.

THE FASCINATING FUTURE OF METAL TELLURATE MATERIALS

Identifying the structure of new materials is often the first step to unlocking their potential applications. A research team involving scientists from Finland and Austria recently determined the structure of a new material that has the potential to be used in solar energy, batteries, and splitting water to produce hydrogen. The international group successfully created a single crystal of a metal tellurate compound, making it possible to precisely define its structure with better accuracy than ever before.



DOI: 10.1039/D3MA01106B



USING PAPER PULP TO SCRUB WASTE FROM EMISSIONS

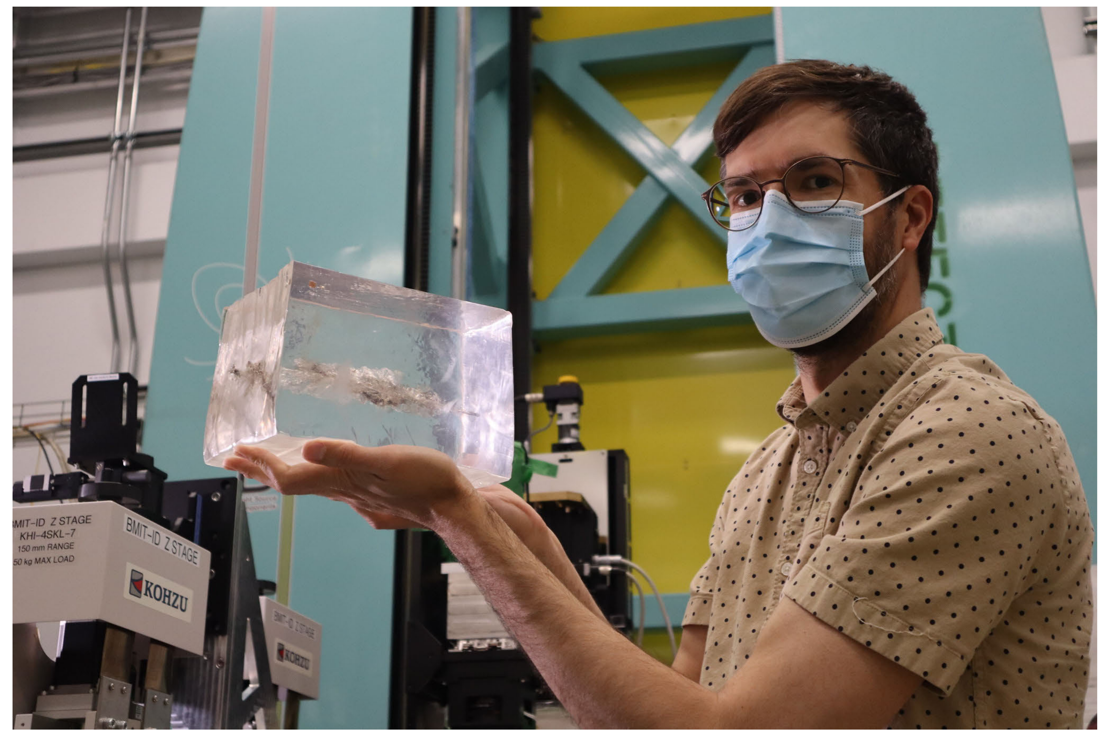
Capturing carbon emissions is one of the most exciting emerging tools to fight climate change. Researchers at McGill University have come up with an innovative approach to improve the energy efficiency of carbon conversion, using waste material from pulp and paper production. The technique they've pioneered not only reduces the energy required to convert carbon into useful products, but also reduces overall waste in the environment. The team used our beamlines to observe chemical reactions in real-time, mimicking industrial processes as closely as possible. They hope to expand the range of products that can be made with CO2.

DOI: 10.1039/D3SU00379E

TURNING WASTEWATER INTO FERTILIZER

Farmers rely heavily on fertilizers to help feed the world's over seven billion people. However, the only commercially available method to produce ammonia-- a key ingredient in fertilizers-- is not environmentally friendly. Scientists recently developed a new process for converting nitrates in industrial wastewater into ammonia. the team, from Rice University, hope that one day wastewater can be used to produce the valuable fertilizer chemical without generating more carbon emissions.

DOI: 10.1038/s41467-021-23115-x



Adam Leontowich, CLS

RISKS OF LEAD EXPOSURE IN GAME HUNTING

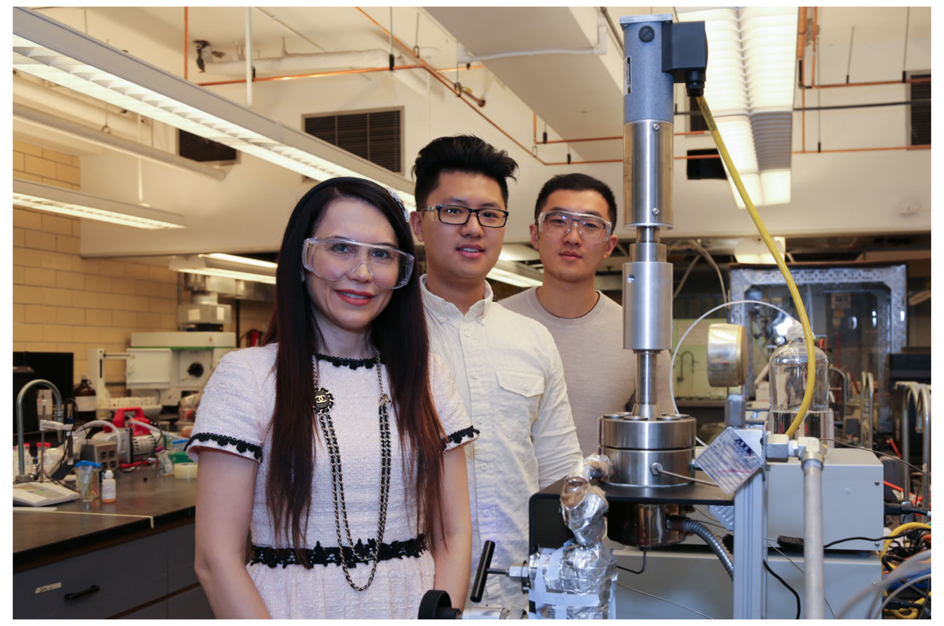
Researchers from the CLS and USask used synchrotron imaging to study both the size and spread of bullet fragments in big game shot by hunters. The lead in some bullets used for hunting deer, moose, and elk is toxic to the humans who eat the harvested meat and to scavenger animals that feast on remains left in the field. They found that the bullet fragments were both smaller and more widely dispersed than previously thought. They conclude by recommending that copper bullets be used in place of lead, due to the clear health and safety concerns with the use of lead bullets for game hunting.

DOI: 10.1371/journal.pone.0271987

RECYCLING PRECIOUS METALS WITH CAPTURED CO2

University of Toronto researchers pioneered a method for using captured carbon dioxide to harvest precious metals from electronic waste such as car batteries, wind turbine magnets, and fluorescent bulbs. Electronic waste is a rich source of vital resources, where they are found at a rate of 20 to 38%. Conventionally mined ores typically only contain 1 to 2% concentrations of rare earth metals. The recycling technique the team has honed involves heating and pressurizing CO2, transforming it into a fluid. Then, it can be used to dissolve and extract critical metals from their surroundings. The big advantage of CO2 is that you don't have to get it very hot to initiate this conversion – only to about 30 degrees Celsius.

DOI: 10.1021/acs.inorgchem.2c04508



Left tot right: U of T researchers Gisele Azimi, Yuxiang Yao, and Jiakai Zhang