

SUPPORTING CANADA’S SECURITY, SOVEREIGNTY, AND DEFENCE

ADVANCED MATERIALS FOR DEFENCE AND AEROSPACE: NEW-GENERATION METALS

Nanostructured high entropy alloys – metals made from a chaotic mix of several different elements – are promising materials for aerospace and automotive applications due to their strength and heat resistance. However, they are costly and energy-intensive to produce. Researchers at the University of Toronto found that electrodeposition – which involves dissolving metal ions in water then using an electric current to pull them out of the liquid and form solid materials – offers a more affordable way to manufacture these advanced alloys.



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PROTECTING CRITICAL INFRASTRUCTURE: SUSTAINABLE FERTILIZERS



Ammonia, a key ingredient in fertilizer, is typically produced using an energy-intensive process that generates significant emissions. Researchers at McMaster University have developed a cleaner approach that uses renewable electricity to convert nitrate pollution in water into ammonia. By using the CLS to improve the reaction catalyst, the team increased the process's efficiency, offering a potential way to reduce emissions, clean contaminated water, and produce fertilizer more sustainably.

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BIODEFENCE AND HEALTH SECURITY: 3D-PRINTED LUNGS

University of Saskatchewan researchers have developed 3D-printed lung tissue models to improve the study of diseases such as tuberculosis and cystic fibrosis. Using special bioinks containing live cells, the team created a three-dimensional model that more closely mimics human lungs than traditional lab or animal models. Analysis at the CLS confirmed the cells can survive within the printed tissue, advancing efforts to develop better treatments, personalized therapies, and potentially lab-grown lungs for transplantation.

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CRITICAL MINERALS AND STRATEGIC RESOURCES: NEW SOURCE OF VALUABLE METALS

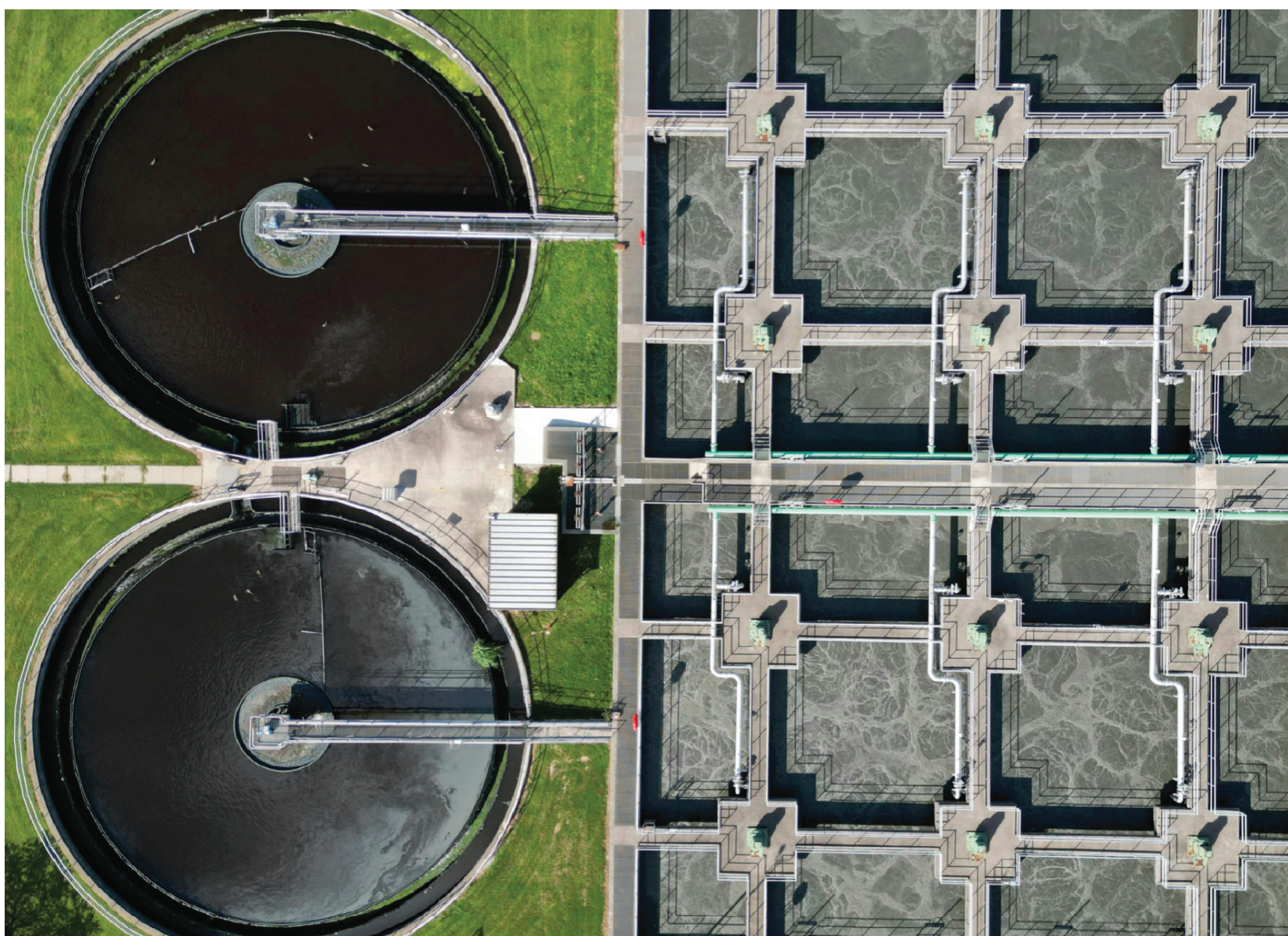
Mineral concretions are rock-like formations found on the ocean floor that may be a valuable source of metals and play an important role in marine ecosystems. Researchers from Finland studied concretions from the Baltic Sea and found that their shape and composition are influenced by water movement, seafloor sediment, and oxygen levels. The findings help us understand how these metallic lumps develop and how long they may take to recover if harvested.



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QUANTUM AND EMERGING TECHNOLOGIES: SLUDGE TO SEMICONDUCTORS

Researchers in Denmark and Greenland have developed a method to convert toxic arsenic waste into a valuable material for semiconductors and clean-energy technologies. Arsenic often pollutes groundwater and mine sites and leaves dangerous sludge after water treatment. The team studied a glassy metallic form of arsenic created from that sludge. The resulting material can be used in batteries, chips, and other green technologies. They are now exploring how the process can be scaled up for use in real-world water treatment facilities.



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ARCTIC SOVEREIGNTY AND NORTHERN OPERATIONS: CLEANER WATER



As mining expands in Northern Canada, researchers are exploring low-cost ways to protect groundwater. Scientists from Yukon University Research Centre and the Université de Moncton tested a permeable reactive barrier (PRB), a natural filter made of gravel, iron, and wood chips. The system successfully removed arsenic and uranium in cold conditions but was less effective at removing nitrate. Although sodium acetate improved nitrate removal, it reduced uranium treatment performance. The study supports the development of sustainable water treatment solutions for northern climates.

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