IMER 2019 RESEARCH IMPACT

Note: Figures relate to CRC ORE

Minerals Dashboard

2010	23	5	54		$2m
Founded	Participants	Research Programs	Research Projects	Cash Received	UoA Receiving

CASE STUDY #2

World-first capability with prototype in the University

An exciting breakthrough was achieved in 2019 by the Fluorescence project supported by the Cooperative Research Centre for Optimising Resource Extraction (CRC ORE).

The centre is focused on optimising resource extraction with a goal to transform the minerals sector by developing innovative world-class technology to increase value across whole-of-mine systems.

Aiming for improving operational value and reversing the marked international trend of declining mineral productivity, other focus areas include reducing mining water and energy use, and CO_2 emissions by up to 20%.

"In 2019, we made strong progress, discovering 'novel' fluorescence signatures and showing their value in mining," says Professor Nigel Spooner, Professor of Physics, and Head of the Prescott Environmental Luminescence Laboratory (PELL) at the University of Adelaide.

Professor Spooner leads the research collaboration, Environmental Luminescence Group, responsible for the breakthrough. His group has received funding from CRC ORE (for fluorescence), and the Australian Copper-Uranium Hub (for radionuclides in mineral processing).

The program sprang from a joint workshop held between IMER and the Institute for Photonics and Advanced Sensing (IPAS) in 2013, reviewing mining and mineral processing problems to raise awareness of opportunities for creating photonics-based solutions.

> "The mining industry needs to know what minerals are in the rocks in order to process them," says Professor Spooner.

"Light is playing a new role through our discovery of 'novel' fluorescence emissions from minerals – a process called 'up-conversion'.

Our team at the University discovered that some minerals have a unique signature, so they can now be identified on a conveyor belt."

This world-first capability has its prototype in the heart of the University, as a result of the 2019 special funding from CRC ORE. Industry partners, including mining companies and the Western Australian Government, have provided a further $620.000 funding for a new project (CRC ORE P1-014) to develop this sensor as a prototype and test it in collaboration with local company, Scantech.

This important work also contributes to CRC ORE's goal of maximising productivity to reduce the impact of the world's declining ore grades.

"CRC ORE's themes have been the subject of higher-degree studies here at the University through the contributions of scholarship and PhD programs, and a significant flow-on effect is the new ARC Training Centre. Lots of threads have come together to see the University of Adelaide recognised internationally as one of the strongest international training centres in mining."

For further information see https://www.crcore.org.au/.

Further breakthroughs with major impact for the mining industry

Professor Spooner says that two further exciting wins were achieved through the Research Hub for Australian Copper-Uranium. (See separate story on page 11).

"The first followed our breakthrough in detecting radioactive lead and polonium atoms on a micron spatial scale in mineral processing products, using a combination of alpha particle autoradiography and NanoSIMS.

"The second was the development of a new way of detecting alpha and beta radiation in real time in mineral processing solutions, using radiation-sensitive fibre-optic sensors," he explains.

The team explored ideas hatched from old-school photography to discover a nuclear emulsion gel that shows the very low levels of radioactivity emanating from mineral samples.

"The impact of radioactivity in Olympic Dam and other sites around the world where crushed ores release multiple hazardous radionuclides has been a problem for decades," says Professor Spooner.

"We revisited 1950s nuclear tracking technology and used photographic nuclear emulsion gel to 'develop' a 3D snapshot of alpha particles on the ore.

We achieved a 'world first' in imaging alpha particle tracks from mineral processing products, and tracing the tracks back to the tiny radioactive mineral grains emitting them. This opens the door to new ways of processing low-grade ore deposits that are radioactive, notably the difficult but high-value iron ore-copper-gold-uranium (IOCG-U)."

> This was a powerful discovery that will have a major impact on the mining sector of the future, with vastly improved productivity and profitability.

"All this exciting work and our discoveries promote the University's reputation as a centre of advanced mineral research, together with IPAS.

"IMER are the essential instigators and the motivators for all the players involved, by providing the real-world application problems to tackle, and IPAS brings the technology – I like to think of it as IMER providing the playground and IPAS bringing the toys," says Professor Spooner.

A major 2019 spin-off from the PELL and the Australian Copper-Uranium Hub has also been the creation of the University of Adelaide's Centre for Radiation Research, Education and Innovation (CRREI).

"BHP funded us to create a radionuclide analysis capability in Adelaide because of its vital significance to the future of useful minerals here," explains Professor Spooner.

"Through the Copper-Uranium Hub's use of BHP-targeted funding of just over $1m, we now have leading-edge capability and state-of-the-art radiation measurement technology for research and commercial services."

For further information see https://www.adelaide.edu.au/copper-uranium-research/ and https://crrei.com.au/.