Building momentum on rare earths research and development

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The Rare Earths Research Symposium was held at University of Queensland (UQ) in Brisbane on 31 May, with more than 70 attendees from industry, academia and government to discuss emerging research questions surrounding the full product cycle of rare earths minerals. More than 20 participants travelled from overseas and interstate to attend the event.

Rare earths are crucially important elements for modern technologies, including renewable energy generation and storage, energy efficient lights, electric cars and digital electronics, as well as for the aerospace and military applications. The sector is dominated by China which currently produces about 90 per cent of these elements and limits their supply to other countries with strict export quotas. The objective of the symposium was to identify how the researchers from UQ and their colleagues from other institutions could contribute to the development and revival of the rare earths by overcoming the supply chain constraints and responding to environmental concerns regarding the production and recycling of these elements.

The collaborative one-day Rare Earths Research Symposium was organised by the University of Queensland's Sustainable Minerals Institute (SMI), an internationally recognised research leader in developing, promoting and applying the sustainability practices to the mining and minerals sector. The collaborators of the event also included Australia's national science agency, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and other research institutes and government bodies worldwide.

At the symposium, the UQ Rare Earths team – led by Professor Saleem Ali – introduced a new research consortium which seeks to bring together leading international academics, industry practitioners and policy makers to discuss the full product cycle of rare earth minerals. The consortium was initially funded through the SMI's NextMine™ initiative, a collaborative effort between engineers, scientists and social scientists to integrate knowledge across various aspects of mineral research in order to prepare the industry for the next generation of challenges that are likely to occur.

Presentations

UQ Pro-Vice-Chancellor (research and international), Professor Alan Lawson, formally opened the inaugural event and set the scene for a collaborative learning session across multiple

The Rare Earth project in Malaysia

Dr Zaidee bin Laiden's presentation was in the context of Malaysia's recent experiences in Kuantan region, where the Lynas Advanced Materials Plant (LAMP) is located, and the opportunities for developing a broader eco-industrial park in that region as well as a green technology hub for South-East Asia. This could contribute to the Malaysian Government's goal to become a developed country by 2020 by creating a greener economy for the nation.

Malaysia is well poised to make a significant contribution to the rare earths sector globally, from mining to production and downstream ventures. However, LAMP is not Malaysia's first time to produce rare earths with the Asia Rare Earth (ARE) project operating in 1982-93.

Professor Yoshihiko Wada provided an insight into some of the environmental conflicts which have emerged in Malaysia as a legacy of the ARE venture that operated during a time of minimal ecological regulation. Professor Wada has investigated the radioactivity levels and social conflict issues that are associated with the ARE operations in Malaysia between the late 1970s and early 1990s. Due to poor waste management processes at the site, pollution by Thorium 232 and heavy elements usually associated with the processing of rare earths ores contaminated some of the surrounding areas.

ARE was a joint venture company established between Japanese and Malaysian corporations with the largest shareholder being Mitsubishi Kasei (now Mitsubishi Kagaku). Mitsubishi Kasei processed rare earths in Japan up until the early 1970s when the regulations for nuclear reactors and associated industries were amended and strengthened; resulting in Malaysia having some of the most stringent radiation compliance standards. A court case on environmental health damage related to the incidence of leukaemia was taken to the regional High Court in 1985 and in 1992 the court ordered that operations cease. In 1993 the Supreme Court overruled this decision however Mitsubishi Kasei closed the plant independently in 1994, supposedly without treating or properly disposing of the wastes and a permanent waste disposal facility was built only in 2003.

disciplines, highlighting the platform that the symposium offered for new research at an international scale at UQ.

The keynote presentations were made by:

- Professor Roderick Eggert, Director of the Division of Economics and Business at the Colorado School of Mines and Deputy Director of the Critical Materials Institute, USA
- Dr Ahmad Zaidee bin Laiden from the Academy of Sciences, Malaysia
- Professor Yoshihiko Wada from Doshisha University in Kyoto, Japan
- Dr Keisuke Nansai from the National Institute for Environmental Sciences, Japan.

Group sessions

Sessions included participatory workshops to develop a series of new research trajectories for the Consortium to consider. The group sessions were kept small to create an intimate experience for exchange with each group given high level directional questions to guide productive conversation and ensure usable and relevant outcomes in identifying the current gaps and discussing potential opportunities for initiatives, papers and research.

Some example questions included:

- National and international governance:
    - What should be the respective roles of government initiatives and supplier-consumer actions and alliances?
    - How do the approaches of 'resource-rich' nations (eg USA) compare with those of 'resource-poor' nations (eg Japan, EU, South Korea)?
- Could we achieve better results investing in recycling projects? What are the key areas for rare earth elements recycling?
- Communicating with the local community: What have been past mistakes, and what is the best strategy to overcome these?

Inspired by the key note presentations, the workshop groups focussed on the following key research themes:

International governance

This group focussed on how international governance can be improved to facilitate improved collaborative relationships between stakeholders and ensure long-term and sustainable global outcomes. The supply chain of rare earths is heavily dependent on a stable and well-coordinated geopolitical environment.

Industrial ecology

This group considered the industrial ecology challenges and opportunities in the rare earths industry. Considering the extraction and processing challenges facing the industry, enhancing the ability to create a comprehensive loop from mining to recycling is becoming an increasing priority for the downstream users in the sector.

Nuclear risk and social conflicts

This workshop focussed on gaps in the perceived and real nuclear risks and social conflicts. There has been ongoing sensitivity around the processing and production of rare earths, given its thorium by-product and its associated potential health and environmental risks. There has been local opposition to Lynas' processing plant in Malaysia for this reason.

Economic determinants

This workshop examined the economic determinants and future contributions of the sector to a green economy. The group discussed how the upstream, midstream and downstream operators could collaboratively contribute to more sustainable economic outcomes for the rare earths sector.

Conclusion

Some of the key findings of the 'gap analysis' carried out during the symposium revealed an urgent need to undertake research on regional economic development potential

The four breakout sessions at the UQ Rare Earth Symposium.

from vertically integrating rare earth industries; industrial ecology approaches to rare earth material flows including recycling versus mining potential; and pollution flows from mining of rare earths worldwide.

Dr Laurie Hutton, Director – Exploration Attraction from the Geological Survey of Queensland, being one of the symposium's attendees, concluded: 'the volume of rare earths required is small by traditional mining standards but their impact on many modern technologies is large if product is not available. Protocols for administering rare earths mining are still being developed, further research is important for regulators and potential miners'.

High quality video footage, presentation slides, conference photos and other materials are available from the CSRM website: www.csrm.uq.edu.au/rareearths/symposium/symposium-materials.

In coming months SMI will continue to build momentum for the ongoing rare earths research consortium initiative with a focus on the geopolitical, economic downstream industries, industrial ecology, and nuclear risk and associated social conflict spheres that envelope the rare earth research agendas. For more information on how to engage with the Rare Earths Consortium go to: www.csrm.uq.edu.au/rareearths/consortium-eoi. ■