CIRCULARITY AND THE IMPLICATIONS OF THE NEW CRITICAL RAW MATERIALS ACT

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Associate Professor, David Peck, researches and teaches, cross faculty, in the fields of critical materials and circular design, in particular developing remanufacturing. He is a founding member of the TU Delft Critical Raw Materials working group, the Circular Built Environment Hub and the Delft Circularity Impact group.

David is also an adjunct Professor at MIP Politecnico di Milano, Graduate School of Business. David is an Executive Board Member for EIT Raw Materials and ERMA. David also works with ad hoc committees in the European Union in Brussels, The Netherlands Government in The Hague, and is a Horizon Europe reviewer.

David sits on the steering committee for the European Remanufacturing Council. He is the TU Delft lead scientist for EU Horizon Europe & Horizons 2020 projects CiRCLE-TECH, Pop Machina, ProSUM, ERN and FP7 CRM_Innonet.

David is TU Delft scientific leader for the EU KIC EIT Raw Materials, representing the university in the programme. David sits on the TU Delft CRM core working group, representing his faculty in developing actions in the field.

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TOWARDS VALUE-ADDED SUSTAINABLE MINING

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The climate change mitigation forces the world to adopt low carbon economy to meet the max 1.5–2 °C temperature increase limit. According to Science Based Targets[1] this means that most companies globally are required to reduce their emissions by 90 % or more before to reach net-zero. These kinds of targets are challenging to all industry but especially to mining industry due to the heavily increased demand for metals caused by the simultaneous green energy transition taking place. Over 3 billion tons of minerals and metals will be needed only to deploy wind, solar and geothermal power, as well as energy storage, required for achieving a below 2°C future[2].

The 3 biggest challenges in the mining industry are the waste rock, tailings and mine waters. Mining industry currently produces over 10 billion tons of mine tailings annually and it is estimated that the volume of tailings will double by 2025[3].

In the circular economy, ore is mined and processed, but opportunities are explored for waste to be processed to create by-products that could be used by the mining industry itself or by other industries. Ecodesign, on the other hand, considers environmental aspects at all stages of the product development process, striving for products which make the lowest possible environmental impact throughout the product life cycle.

What the mining industry presently needs most is a holistic approach all through its value chain from exploration of raw materials to the products including waste reuse and sustainable product after life. This presentation will discuss the opportunities created by systematically implementing circular economy and ecodesign concepts in mining operations and value chains.

[1] https://sciencebasedtargets.org/net-zero
[2] Climate-Smart Mining Initiative, The World Bank. https://www.worldbank.org/en/programs/climate-smart-mining/overview (retrieved 22.5.2024)
[3] Hamraoui, L.; Bergani, A.; Ettoumi, M.; Aboulaich, A.; Taha, Y.; Khalil, A.; Neculita, C.M.; Benzaazoua, M. Towards a Circular Economy in the Mining Industry: Possible Solutions for Water Recovery through Advanced Mineral Tailings Dewatering. Minerals 2024, 14, 319. https://doi.org/10.3390/min14030319

Dr Jutta Nuortila-Jokinen has recently retired from her Industry Professorship in the Department of Separation Science at LUT University but still holds her Docentship (Adjunct Professorship). Her special field of expertise lies in holistic approach and deep understanding of separation technology when developing value added and environmentally benign processes and services for process industry. Especially, combining life cycle and customer focused approach to creating value through the whole value chain is her particular interest. Her research focuses on circular economy, ecodesign and treatment of industrial waters. This includes, e.g. utilisation of industrial side streams in creating value added sustainable products, designing low impact circular products/processes/services utilising ecodesign principles, and improving water efficiency in water-intensive process industry by utilising different advanced separation and recovery processes.

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CIRCULARITY IN POLICY IMPLEMENTATION

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The demand for battery materials has been growing rapidly following the increasing need for electric vehicles (EVs) and energy storage, enabling a transition towards low carbon systems. Currently China dominates battery manufacturing and most of the materials originate from developing countries, where extraction has been associated with negative environmental and social impacts. European Union (EU) has outlined aims to increase self-sufficiency on battery materials, promoting a diversified supply of primary raw materials and increased circularity of materials and products. EU has taken steps to integrate the principles of circular economy in its policies, such as the new battery regulation and the raw materials act.

This presentation discusses the integration of the principles of circularity in EU battery and raw materials policy. The focus of the presentation is on circular applications outside conventional recycling: 1) secondary lithium sources and 2) second and third life repurposing of EV batteries.

Laura Kainiemi is a postdoctoral researcher at LUT University, specializing in the circularity of inorganic materials. Her research focuses on socio-economic systems, sustainability transitions, and the interactions between actors and institutions. Her interests include social sustainability, policy, and just transitions.

OPPORTUNITIES OF INCREASED RECOVERY – AN SME PERSPECTIVE

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Recovery losses are significant throughout the metal value chain from ground to final metal produced. According to a study from Oulu University from 2021, up to 40% of valuables are lost in mining and mineral processing. Recovery losses at concentrators can vary from 5 to 30% depending on the mineral being processed. With a conservative recovery loss of 5%, we are losing 130 million tonnes of iron ore, 3.45 million tonnes of aluminium, 2 million tonnes of chromium, 1.1 million tonnes of copper, 1 million tonnes of manganese and 375,000 tonnes of technology and precious metals annually. According to McKinsey, the supply gap for copper by the end of the decade will be 6.5 million tonnes.

On one hand, the development of new mines is slow and comes with high uncertainty over metal prices and the *economic feasibility of the mine. On the other hand, the green transition is heavy in metal demand and geopolitics affect metal supply, and subsequently their prices.

Addressing recovery losses presents opportunities for new technologies and approaches to producing the metals in need. Recovery losses at concentrators, particularly at concentrator thickeners and filters, can be addressed by employing fine filtration technology to recover fine particles that otherwise escape conventional processing. Furthermore, soluble metals can be recovered by highly selective 4D scavenging. Addressing losses have direct economic impacts and impacts on security of supply, but can also have favourable environmental impacts, when the load on our environment is further reduced.

Riina Salmimies is the CEO of Sofi Filtration, a Finnish technology company designing and supplying the mining industry with advanced fine filtration solutions. Before joining Sofi Filtration, she held the position of dean of the LUT School of Engineering Science. She holds a master's degree in process and plant design, a doctoral degree in filtration and a master's degree in business. She has 20+ years of broad experience in chemical engineering, of which 15+ years have been spent on mining and mineral processing applications. She holds Board positions in Sofi Filtration and in the Finnish Association of Mining and Metallurgical Engineers.