

Impressions from the first SusCritMat Winter School

Les Diablerets, Switzerland, January 14-19, 2018



The education project Sustainable Management of Critical Raw Materials (SusCritMat), funded by EIT Raw Materials and running from 2017 to 2020, aims to understand the role of critical raw materials in the whole value chain and to share this knowledge with current and future decision makers in industry and academia. The SusCritMat Winter School 2018 brought together educational and technical expertise of leading European educational institutions and business in an interdisciplinary approach. The participants valued this approach and enjoyed the stimulating perspectives from other fields – not only by working together on assigned projects, but also by getting to know the fellow participants and experts during their free time in the Swiss mountains.

SusCritMat provides the participants of its schools with the opportunity to discuss and work with experts in various fields affected by materials criticality. The project aims at highlighting the bigger picture and the interconnected nature of global business and society. By developing new skills and competences, and by enlarging the participants' professional network, SusCritMat responds to the increasing need for additional knowledge and solutions in industry and research in such differing fields as materials science and environmental science, geology and mining engineering, economics and law, and various other disciplines.

Novel educational concept

Via presentations, discussions and hands-on exercises with mentors of the partner institutions – leading and renowned experts in their field – participants enlarged their knowledge during the winter school amongst others in:

- **Fundamental concepts** underlying materials criticality,
- **Assessment of information** to perform own calculations on the economic importance and supply risk of metals,
- **Life cycle and material flow methods** related to stocks and flows of materials and environmental footprinting,
- **Ecological and social aspects** emerging through demand for materials throughout the whole value chain,
- **Resource efficiency and eco-design** approaches on how to make informed choices on sustainable materials use,
- **Policy, certification and standards** related to raw materials use which are currently important for decision-makers or might become it in the near future,
- **Economic aspects** of raw materials markets, economic influence of raw materials on products and possibilities of alternative business models,
- **Recycling and waste management** of end-of-life products, possibilities to recover critical raw materials, and ways to consider these aspects already in the design stage,
- **Knowledge on available tools and data** for making informed choices related to all discussed aspects.



Nine working groups were created, each engaged with a specific **product component**. By taking a company's perspective, the participants applied their **newly acquired knowledge** to analyse and discuss the economical, technological, environmental, social and legal issues surrounding their component, such as a flat screen in a mobile phone, a battery in an electric bike or a solar panel in a lamp. All products were available on site for inspection and deconstruction. Finally, the participants had to come up with a

recommendation concerning “their” company's further **strategy** on the raw materials use related to the component, and to **present** this at the last day of the 5 day winter school.

Judging from the high quality of the outcomes and by the participants' feedbacks, this approach proved a success. All nine presentations showed an in-depth understanding of the relevant issues, and participants stated that they appreciated the opportunity to apply theoretical knowledge to finding solutions to practical problems.



Course of the Winter School week

Day 1 of the winter school served as an introduction to critical raw materials and the issues surrounding them. **David Peck** from **TU Delft** started with the history of solutions for critical materials. He showed that the wars of the 20th century made governments aware of the **strategic importance of materials for military deployment**. However, popular awareness of critical materials has only risen recently due to their **importance for new technologies**. Prof. Peck concluded by stating that materials criticality can only be managed by adopting a sustainable approach based on ideas from a framework of engineers, business and society as a whole. From the point of view of experts in mineral resources, **Dominique Guyonnet** and **Gaëtan Levebre** from **BRGM** underlined the world-wide increasing demand of materials and the nature of criticality as a dynamic, ever-changing characteristic. The lecture was complemented by a hands-on exercise on criticality indicators, which showed at the example of the current EU methodology on criticality how the choice of different parameters influences the outcome of what is critical and what not. The lecture and exercise on criticality can be downloaded for free [here](#). **Ester van der Voet**, **University of Leiden**, devoted herself to the topic of Material Flow Analysis (MFA) with its core principles of a system's perspective. She showed that MFA methodology is based on three steps: goal and systems definition, quantification and interpretation of the results. A corresponding exercise complemented the participants' understanding of the method.

On day 2, **Guido Sonnemann** from **University of Bordeaux** presented an overview on the various environmental impacts that have to be considered in the environmental evaluation of products. His introduction was followed by a presentation and exercise by **Stefano Cucurachi**, **University of Leiden**, introducing the science of **Life Cycle Assessment (LCA)**, which allows to study the environmental impacts triggered by product systems across their full life cycle – from the extraction of raw materials to disposal at end of life. The **social aspects** of LCA were then presented by Guido Sonnemann, showing that the results of such analyses should help today's and future generations in their well-being, bringing together society, economy and environment. **Antti Roine** and **Markus Reuter** from **Outotec Oyi** and **Helmholtz Institute Freiberg** presented **process model based LCA** by using Outotec's HSC Chemistry Software. The lecturers pointed out that life cycles are influenced by certain criteria and showed how these were applied in their software.



On Day 3, **Dieuwertje Schrijvers** from **University of Bordeaux** introduced **minerals certification** as a potential to manage social aspects along the supply chain. It could be concluded that certification is a valuable step forward to take responsibility and increase the transparency of processes and trading. **Jan-Henk Welink** from **TU Delft** discussed **policy, governance and economic aspects**, highlighting how geopolitical factors can lead to volatility in materials' supply. **Tatiana Vakhitova, Granta Design**, introduced a **problem-based methodology for assessment of technologies claiming to be sustainable**. She applied Granta Design's educational software, CES EduPack, and a 5-step methodology (based on work of Prof M. F. Ashby and colleagues) to guide participants through a case study of electric cars. In doing so, she focused on challenges and opportunities related to critical materials, by analysing and comparing their properties and availability on a global scale, as well as their environmental and social impact.

Day 4 highlighted various approaches on how to tackle critical raw materials issues. **Amund Løvik** from **Empa** showed a characterization of urban mines, using passenger cars as an example. The presentation showed material cycles of passenger cars and the fate of critical raw materials in end-of-life vehicles. **Tatiana Vakhitova** presented the advanced use of the CES EduPack software and its Eco Audit Tool to help with an in-depth analysis of an electric tablet case study to gain practical knowledge and skills for **eco-informed materials selection**. **Jan-Henk Welink** then gave an introduction into **waste management**, explaining the various steps of recycling from dismantling over pre-processing and processing options, and showed how recycling depends on economic viability and also on product design. This led to the contribution of **Ruud Balkenende** from **TU Delft**, who elaborated on the challenges of such **eco-friendly design** by exemplifying them on products. The circular economy approach is important in this context, as design is at the beginning of product development, but has to take into account all further steps of processing, manufacturing, recycling and reuse. Finally, **Antti Roine** and **Markus Reuter** gave a presentation on **simulation-based design for recycling & the circular economy**. The presentation covered important aspects of circular economy engineering, metallurgical internet-of-things and resource efficiency. The Fairphone example then allowed an overview of the recyclability of a complex product.

Day 5, the last day of the winter school, was dedicated to the presentations of the nine working groups. The mentors had been present for questions and advice during the whole winter school. The participants presented their projects, applying the knowledge they had gained through the week and using their own experiences from working with industry or academia. The **recommendations and solutions** they came up with showed their understanding of many aspects related to materials over the whole value chain, and the interrelated challenges we are facing today and will be increasingly in the future.



More information and next activities

The next 2.5 day school of the SusCritMat project will take place [from October 24 to 26, 2018, at TU Delft](#) in the Netherlands. Its focuses on the needs of industry, providing participants with knowledge on critical raw materials that is applicable in their daily professional life.

More information on the project is available at <https://suscritmat.eu>



Watch the SusCritMat video:

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