

Meeting report: “17th Society and Materials Conference”. Conference, 2023, Karlsruhe, DE

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The Institute for Technology Assessment and Systems Analysis (ITAS) at Karlsruhe Institute of Technology (KIT) hosted the Society and Materials (SAM) conference on 09–10 May 2023. After a two-year hiatus due to COVID-19 pandemic, the conference welcomed participants back for in-person discussions. Accessibility for all attendees was guaranteed by continuing the tradition of not imposing any conference fees. With a 17-year long history, SAM conferences are globally recognized for addressing environmental and societal challenges, emphasizing interdisciplinary discussions and innovative methodologies. This year's edition featured five sessions that showcased the integration of materials science, techno-economics, as well as environmental and social sciences.

Sustainable innovation as the key to a good Anthropocene?

Armin Grunwald's (Karlsruhe Institute of Technology, KIT) opening plenary talk highlighted the impact of human activities on the planet and how industrialization has contributed to multiple crises, including climate change. Technology driven innovation and a sustainable global society that distinguishes between needs and wants, based on ethical principles, is essential for a 'good' Anthropocene (since a 'bad' Anthropocene is not an option). The UN's Sustainable Development Goals provide a common framework for defining actions towards economic and social solutions where technology plays a role. Technology assessment is vital in identifying innovation potential for sustainable development, and sustainability rules enable the definition

of indicators, target values, and strategies to avoid unintended consequences.

Exploring the energy transition

The first session chaired by Marcel Weil (KIT) focused on the need for energy transition towards renewable energy sources for sustainable development. Weil's keynote explored current challenges associated with batteries as energy storage devices. It is evident that for both stationary and mobile energy storage applications batteries will play a significant role as an electrochemical energy storage technology. Particularly, lithium-ion batteries are widely used due to their technical properties, economics, and operability. However, their sustainability is being questioned due to material demand, production costs, environmental and social impacts, technical disadvantages, safety, and end-of-life treatment. Thus, there is a high necessity to develop new battery chemistries that are more environmentally friendly, techno-economically feasible, and disassociated from negative social impacts. Many new concepts such as sodium-ion, magnesium, zinc, and aluminum batteries are emerging with the promise of better sustainability. The following six presentations offered valuable perspectives on evaluating emerging battery technologies: Viera Pechancová (Tomas Bata University) delved into the social sustainability aspects of these technologies. Sebastián Pinto Bautista (KIT) presented prospective life cycle assessments (LCAs) of novel batteries, including Mg-batteries and metal- and liquid-free organic batteries, whereas Manuel Baumann (KIT) discussed the toxicity screening of precursor materials for sodium-ion battery cathodes. The presentations reiterated the potential of innovation and emerging technologies, highlighting the importance of assessing their unintended risks, as emphasized in Grunwald's plenary talk.

How to decarbonize industry?

The second session chaired by Jean-Pierre Birat (IF Steelman Consultancy), founder of the SAM conference, focused on green processes for a decarbonized industry. In his keynote Jean Jouet (Chief Technology Officer at John Cockerill Group, JC) shared insights into the company's activities in the hydrogen market and its vision for a decarbonized future. JC is focusing on increasing the efficiency of Alkaline Electrolysis (AEL) cells and infrastructure for customers, e.g., through several gigafactories in Europe and Asia. However, he does not see hydrogen as “the” sole solution to a green, fossil-free industry of the future. Saving energy and electrification are more important on a system level. Hydrogen could be produced, when there is a surplus of renewable energy. Jouet criticized the recent exit from nuclear power in Germany and stressed the importance of keeping hydrogen factories for European demand in Europe to maintain prosperity and independence – a very Eurocentric view, which can be seen differently in terms of global (climate) justice. The session included presentations on different approaches to decarbonization such as the use of hydrogen as a reducing agent in the metal industry by Jafar Safarian (Norwegian University of Science and

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Technology, NTNU) or carbon capture as a path to decarbonization using dark earth by Jens Buchgeister (KIT). The session was chaired by Jean-Pierre Birat from IF Steelman, the founder of the SAM conference. The seven speakers presented a wide range of ideas on decarbonization, emphasizing the importance of saving energy and electrification in addition to hydrogen production. The use of hydrogen in different industries and the development of new approaches for waste to value were also discussed. Overall, the session provided very valuable insights into various aspects of decarbonization and the role of hydrogen in achieving a green, fossil-free industry of the future.

Is this the real life, is this just fantasy?

During the third session on the second day, chaired by Jan Bollen (ArcelorMittal Company), three presentations focusing on Material Flow Analysis (MFA) showcased interdisciplinary discussions and the use of fictional literature to explore innovative solutions for real-life challenges. Romain Guillaume Billy (NTNU) delivered an outstanding presentation that applied Industrial Ecology techniques, such as MFA, to the fictional realm of Frank Herbert's *Dune*. This provided a unique way to explore

sions to determine the predominant political sphere associated with the term "justice".

Advances in life cycle assessment

The fifth session, chaired by Gaël Fick (IRT M2P), delved into methodological aspects of LCA and featured six experts. Ignaas Verpoest (KU Leuven University) discussed the energy intensity of carbon fiber production and the discrepancies in published values reported by the industry. He identified the different nature of input data used to construct models as a potential reason for the divergent results. By acknowledging this, researchers can now take steps towards achieving more consistency in data collection, analysis, and reporting to ensure better reliability and accuracy of results. Jens Peters (University of Alcalá) highlighted the variability in the environmental impacts of electricity production when considering average and marginal mixes in LCA studies. Peters' research raised concerns about the need for consensus within the LCA community on how to account for electricity and the importance of better integration of data on electricity generation. His presentation provided valuable insights into how LCA practitioners can improve the accuracy and ro-

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ecosystem trade-offs and mechanisms and illuminated Herbert's visionary mindset, which had explored topics such as climate change, material extraction, and their effects on society and ecosystems before they were prevalent in social or academic discussions. Saskia Ziemann (KIT) shifted the focus to a currently existing real-life problem by presenting significant research progress in understanding complex interrelationships and solutions to prevent plastic discharges into the environment.

Social Science and Humanities

In the fourth session, chaired by Kathie Birat (Université Lorraine), a panel of five speakers offered insights on several pertinent subjects in Social Science and Humanities, such as sustainable cities, citizen science in materials research, and education of citizens for process development. The keynote delivered by Jean-Pierre Birat encompassed a broad range of developments pertaining to hydrogen, including its historical evolution, present-day advancements, and potential future prospects, with a particular emphasis on net-zero hydrogen and its applications in industry. Rabea Scholz (University of Potsdam) delivered an exceptional presentation on how justice is portrayed in German media and official government documents, considering its relationship with other policy domains. Scholz offered an analysis of justice trends in Germany and scrutinized media discus-

business of their assessments. Overall, this session demonstrated that LCA is a constantly evolving field, and that there are significant strides towards developing better methods and practices for conducting more accurate and reliable LCA, such as rigorous and standardized methodologies in environmental sustainability assessments. By addressing methodological challenges, researchers can improve the accuracy of sustainability assessments and provide more reliable data to inform policy decisions and lead us towards a (hopefully) more sustainable future.

As we look ahead to the 18th edition of the conference, we should strive to continue the same level of curiosity, inquisitiveness, intellectual boldness, and innovative thinking that has characterized the previous gatherings. By doing so, we can continue to deepen our understanding of the complex interplay between materials and society and develop effective strategies for addressing the challenges that lie ahead.

Information

https://www.itas.kit.edu/veranstaltungen_2023_sam17.php