

## Successful workshop on Electro Mobility - Assessing the Shift from Energy Efficiency to Material Efficiency in the Automotive Life Cycle at the Hanse-Wissenschaftskolleg

Around 30 experts from all around the world came to Delmenhorst, a small city located between Oldenburg and Bremen, to discuss material related topics on the automotive life cycle. Why are materials of such high interest to gather together for 3 days to brainstorm on future needs? Everyone knows that automobiles have become lightweight, smarter, safer and more electric. Each of these trends has demanded new types and new combinations of materials – materials that have become more complex.



Figure 1: Participants of HWK Workshop on electro mobility (June 17<sup>th</sup>.2014)

This workshop suggested that in the future the dominant challenge for developers and manufacturers of cars may no longer be issues of energy efficiency and fuels. Instead new questions are growing on the use of new, sometimes scarce and environmentally problematic materials, which challenge the life cycle management of automobiles and materials.

Critical metals have already gained attention as important to the automotive sector, due to increased use of electrical devices like motors, sensors and batteries. Cobalt and gallium, rare earth elements (e.g. neodymium, dysprosium, praseodymium and terbium) and other metals are critical in automobiles—and all classified as strategic raw materials. It is therefore important to manage material destiny at the end of service life, with an aim to recover them for further use. There is a lack of data concerning the amount of critical metals in vehicles and on recycling technologies that will need to keep up with rapid changes in material content of future vehicles.

After the intensive workshop the experts identified following needs to further work on:

- a) Life cycle assessment (LCA) of electric vehicles – with the explicit observation that materials issues will dominate as we increase use of cleaner power for electro-mobility.
- b) End-of-life vehicles (ELV) is an area of great activity, including insightful presentations on existing activities and future needs in Germany, Switzerland and Sweden. Participants discussed end-of-life management and recycling technologies.
- c) Critical materials – particularly the “technology metals” – are growing in use in vehicles; yet their recovery and recycling rates are poor and the flows are poorly understood.

The conference keynote speaker, Dr. Andrew Bloodworth from the British Geological Survey provided great insights on critical materials and priorities. As an economic geologist working in this field since decades, his perspective was insightful:

*“Physical exhaustion is not an issue”. Geological resources and “urban mining” together provide abundant resources and environmental limits (as carbon & water) are the “ultimate constraint on resource use”*



Figure 2: Keynote speaker Andrew Bloodworth

In summary we need further approaches to understanding risks and managing for continued access to critical materials. More information such as in material related Sankey diagrams help to characterize and understand individual metal anthropogenic flows.

On day three of the workshops all participants discussed and developed new ideas through a World Café format. One group explored “how to measure material efficiency” and the final consensus was ... “we don’t really know.” Some observations were provided. Concepts of material efficiency covered physical scale from element to material, to component to product, to system and society levels. One preliminary conclusion is that material efficiency is measured at a higher level of scale (as material in component or product, which includes context on use and full life-cycle). Another was that different industrial materials (metals, wood, polymers, etc.) will have different efficiency strategies.



Figure 3: World café Round

The second group addressed the question “How can automotive recycling compete with primary raw material supply”? Interesting discussions followed with ideas on easier and faster dismantling through robotics which might raise car parts theft in the near future and then ideas for smart phone apps to notify the owner that his car is being dismantled. The goal in this group was to come close to a nearly 100% recyclable car and if this is really possible to achieve. Uncertainties and losses during the automotive life cycle and the limits of recycling were some identified outcomes of this group.



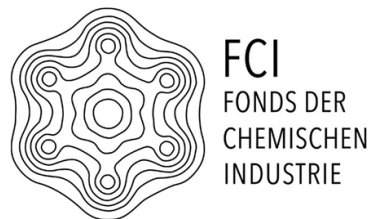
Figure 4: World Café outcomes of Round

In the last group of the world café session further activities and future collaboration was discussed further. All participants agreed to further cooperate on:

- End of Life Vehicle projects on Recycling, Re-Use and Supply Chain Management
- Batteries in Vehicles
- Life Cycle Assessment related to automotives and criticality of elements

Therefore a new platform to get connected and to invite other interested researchers on these topics will be created in the following months, as a pool of bachelor-, master- and phd-thesis and a follow-up workshop in 2015 was also agreed on. Due to the high level of discussions and outcomes everyone agreed that the Hanse-Wissenschaftskolleg is a perfect place for brainstorming and is therefore the meeting place for 2015 again.

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