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SCS Swiss Chemical Society

Conference Report

Swiss Chemical Society Spring Meeting, University of Zurich, April 22, 2016

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Green Chemistry

The 2016 Spring Meeting of the Swiss Chemical Society (SCS) was held at the University of Zurich, Switzerland, on April 22, 2016. The presentation of the Werner Prize was embedded within five plenary talks and the General Assembly of the SCS. Professor Roger Alberto and Professor Greta R. Patzke from the University of Zurich were glad to host a series of outstanding speakers presenting the different facets of 'Green Chemistry'.

Plenary Talks

Professor Martyn Poliakoff (University of Nottingham, UK) opened the meeting with a fascinating presentation illustrating his successful journey towards greener photochemistry over the past decades. His group keeps pushing forward the important mission of implementing photochemical reactions on a larger manufacturing scale. Ground-breaking strategies emerging from his research include clean and continuous oxidation processes with singlet oxygen in supercritical CO_2. His recent work on new photochemical routes to artemisinin as an important antimalarial drug demonstrates how the application of green chemistry principles goes hand in hand with outstanding extents of recycling at near-ambient conditions and drastically lowered production costs. Moreover, the application of CO_2 as a smart solvent in combination with immobilized photosensitizers paves the way to unprecedented processing benefits.

The 25th anniversary of Green Chemistry in 2016 was celebrated by ***Professor Paul Anastas*** (Yale University, USA) as an eminent pioneer of 'The Chemistry of Sustainability'. His inspirational survey of past and future global chemical challenges demonstrated how chemistry underwent a paradigm shift emerging from the postulation of the timeless '12 principles'. They keep guiding chemists towards efficient and elegant production pathways in harmony with recycling, renewables and environmental compatibility as sustainable process design parameters. The driving force that renders Green Chemistry so attractive for the future is the positive race for the best and most elegant overall design from synthesis to upscaling, rather than the mere avoidance of waste and toxic products. This attractive concept is furthermore expected to influence tomorrow's technological and industrial branches to a large extent.

The major progress in green chemistry development at BASF was illustrated by ***Dr. Thomas Güttinger*** (BASF Schweiz AG, Basel) in his 'Short Walk through the Basics and Specialty Chemicals Landscape'. BASF plays a leading role in turning chemical production processes into competitive assets for the economy, for peoples' quality of life as well as for the environment. The different challenges associated with implementing these principles consistently on all scales from special products and intermediates to the 100kt range were impressively compared and illustrated with current examples. A highlight of Dr. Güttinger's presentation was the chemical and technological background of the large scale HPPO process (propylene oxide by hydrogen peroxide) with water as the only side product. Consequently, this innovation won the prestigious 2010 US presidential green chemistry challenge award.

Professor Walter Leitner (RWTH Aachen, Germany) presented a forefront combination of fundamental and application-oriented strategies to tap the full potential of 'Carbon Dioxide as Raw Material for the Energetic and Chemical Value Chain'. CO_2 emerges as a valuable and sustainable carbon source for key chemical processes, such as polymer or methanol production. His group is pushing forward the targeted construction of molecular catalysts to open up the full synthetic potential of the CO_2-H_2 couple to selectively access functional groups through green pathways. A recent Ru-phosphine based breakthrough catalyst for the methylation of amines with CO_2 and H_2 paved the way to a wide range of primary/secondary amines and imines with water as the only side product. Homogeneous green catalysis furthermore opens up fascinating insights into the molecular mechanisms behind green processes.

Ionic liquids (IL) have become a key component for all processes related to Green Chemistry. Their particular solvent effects such as close to zero vapor pressure, or uncommon solubilities due to the presence of different cations and anions, alternate catalytic pathways, and their often increased reactivities make them superior to common organic solvents. ***Professor Paul Dyson*** presented recent results about enhancing catalytic processes by subtle adaption of anions and cations. Insights into the underlying mechanisms were provided, rationalizing the observed processes as *e.g.* degradation of renewable biomass feedstock. The experimental designs can not only be used for degradation but also for activation and conversion of other carbon sources such as CO_2. The presentation covered further

aspects of the versatility of ILs and was in particular educative and inspiring for the young researchers.

The Werner Prize 2016 was awarded to ***Professor Maksym Kovalenko***, ETH Zurich and EMPA Dübendorf, for his innovative studies in the chemistry, physics and applications of inorganic nanostructures. The prize comprises CHF 10'000 and a bronze medal and is awarded annually to a promising young Swiss scientist or scientist working in Switzerland for outstanding independent chemical research. At the time of the award, the candidate should not be a tenured professor or someone in a higher position in industry and should be younger than 40.

Lead halide perovskites were in the focus of his award lecture, 'Nano- and single-crystals of lead halide perovskites: from bright light emission to hard radiation detection', and they are intensely investigated due to their multitude of potential applications in many fields of materials science. As evident from Professor Kovalenko's outstanding research achievements, pure inorganic perovskites of the lead halide type offer numerous advantages which render them superior to the hybrid materials. Convenient anion exchange under ambient conditions for example enables subtle fine-tuning of emission properties of chemically synthesized well defined and mono-disperse perovskite nano crystals, thus permitting emission fine-tuning over the entire visible spectrum range. Beside illustrating cutting-edge properties as emissive semi-conductor materials, Professor Kovalenko demonstrated the possibility of not only growing nano crystals but also inorganic perovskites as large as 1 cm! Such macro crystals may well serve as detectors for high energy γ-rays. With his lecture, Professor Kovalenko showed impressively the quality, originality and the far-reaching scope of his research.

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