

Press release

*nova-Institute GmbH (www.nova-institute.eu)
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From vision to implementation: CO₂ as feedstock for chemicals and polymers

The terms CO₂ economy and Carbon Capture and Utilization (CCU) are becoming an increasingly popular subject in the scientific and popular press. These terms refer broadly to the technical possibility of scrubbing CO₂ from flue gases or from the atmosphere and using it as feedstock to produce chemicals, polymer and so-called “solar fuels“. “Solar fuels” are a generic term for a fuel based chemically on CO₂ and water where a renewable energy source is stored. The word "fuel" is intended in a broader sense, as it refers not only to fuel for transport and electricity generation, but also feedstock for industry. This innovative concept now faces the transition from simple academic curiosity to a feedstock of growing importance to the chemical industry.

Leading experts and 180 participants from 22 countries

In order to pool together different representatives of this important and relatively new field, nova-Institute GmbH (Hürth, Germany) organized a full two-day conference. This allowed the world's leading universities and companies in the field of CO₂ capture, purification and derived polymers, products and fuels to present and discuss their latest developments and outline their vision for the full-scale implementation of a CO₂ economy.

This inspiring conference (in the words of many attendees) was entitled "CO₂ as chemical feedstock for polymers and chemistry" and it was held on 10th and 11th October 2012 in the Haus der Technik in Essen. 180 participants from 22 different countries enjoyed the two-day event. It was sponsored by RWE AG and Bio Based Europe Pilot Plant (Belgium) and was under the patronage of the Ministry of Innovation, Science and Research of the State of North Rhine-Westphalia. Other partners of the event were the European Chemical Industry Council (CEFIC), the Cluster of Industrial Biotechnology of North Rhine-Westphalia (CLIB2021), the Flemish Institute of Technology (VITO) and Kunststoffland NRW.

Six sessions covering the full spectrum of CO₂ utilization

The conference was divided into six sections, one for each field of the CO₂ economy. Every session discussed a specific topic related to the use of CO₂ as future feedstock for the chemical industry in detail, laying out the challenges ahead and the milestones already achieved in the field. Prof. Michele Aresta from Bari University (Italy) and Dr. Gernot Klotz from the CEFIC showed in the early sessions clarified to the audience how the CO₂ economy started out as a vision in the 80s and how this vision is now becoming a reality. Presentations and discussions covered fields ranging from the general vision of a CO₂ economy and how it can change our industries and life in the future to more specific technical fields. These included CO₂ capture and purification, the innovative chemistry required, and the various commercial and pre-commercial polymers that already use CO₂ in their production cycles. They also covered biotechnological processes for feeding microorganisms with CO₂ to produce fuels or biomaterials, and direct CO₂ reduction to hydrocarbons through chemical catalysis.

Innovation Award

During the conference participants had the chance to vote for an "Innovation Award". This symbolic prize was intended as recognition for the three speakers who impressed the audience with presentations of the most impressive and most innovative technologies. Due to the high quality of the speakers and their innovative products and approaches, it was difficult for participants to decide which speakers deserved the innovation awards, and this was reflected in the narrow margins between speakers in the final vote.

Third prize: Carbon Recycling International, Iceland, and the University of Sheffield, UK

Third prize was awarded jointly to Paul Wuebben, senior director at Carbon Recycling International, and Prof. Peter Styring from the University of Sheffield. Carbon Recycling International already produces methanol in Iceland using technology based on direct CO₂ reduction with hydrogen on a commercial scale. The company is based in Iceland as a pilot project to harness geological deposits of pure CO₂ and renewable geothermal energy, and it is already capable of producing roughly 2 million litres of methanol per year. Paul Wuebben also demonstrated in his talk how chemistry that currently uses fossil feedstock starting with methanol can be easily replaced without the need for expensive new infrastructure.

Prof. Peter Styring impressed the audience with his university's new approaches in two different fields. The first is the development of a new polymer that is capable of scraping CO₂ from flue gases without an upstream filtration step, thereby introducing a fundamental simplification. The other is a strategy for obtaining aviation fuel from CO₂, thus offering the aviation sector a concrete way of reducing its carbon footprint.

The German company SolarFuel GmbH was only just edged out of 3rd place and deserves a mention for their process that produces methane for vehicles from surplus wind farm electricity in northern Germany. Solarfuel is pursuing this strategy in cooperation with Audi and Siemens, demonstrating that companies with expertise in different sectors are already achieving the vision of a CO₂ economy today.

Second prize: Munich University of Technology, Germany

The second prize was assigned to Prof. Bernhard Rieger from the Munich University of Technology. In his enlightening talk he pointed out the importance of catalyst design in a key step of the CO₂ economy, for example in activating the CO₂ molecule for additional uses. Prof. Rieger also provided some invaluable "rules of thumb" for selecting promising pathways from the multitude of possible strategies that are constantly being put forward in the scientific and popular press. Together with other speakers from companies such as Bayer Technology Services and BASF, as well as the US based Novomer and Empower Materials, he showed the potential of CO₂-based polymers, which can be used in several applications and some of which are already on the market. One particular example is the combination of CO₂-based polypropylene carbonate (PPC) with bio-based materials such as PLA or PHB being used for experimental production of vacuum cleaner plastic parts by Siemens together with BASF and Prof. Rieger. Preliminary results are very promising.

The total commercial production of PPC polymer can be estimated by a few thousand tonnes per year, and the production capacities for this polymer are increasing significantly. It is mainly used in the packaging sector due in part to its key biodegradability properties, as well as to improve bio-based plastics' mechanical properties. The Korean company SK Innovation impressed the audience with its production and commercialization of GreenPol™, a versatile, multipurpose PPC.

The winner: Lanzatech, New Zealand

Dr. Sean Simpson from Lanzatech, a dynamic biotechnology enterprise based in New Zealand, won first prize. His company revolutionizes the field of biotechnology with an innovative approach harnessing CO₂ through genetically modified bacteria to produce ethanol and a wide range of chemicals with a very simple reactor design and under mild, low-energy-input conditions. This concept not only proved that it could function in a pilot plan in New Zealand where the process has been optimized, but has also been industrially scaled up in different parts of the world such as China, Russia and USA. Lanzatech successfully upgraded its biotechnological toolbox and will start to produce other interesting chemicals such as organic acids and biohydrocarbons in the future. Alongside Lanzatech, Evonik Industries is the other main company working in the field of valorizing CO₂ as feedstock for fermentation processes.

Several aspects of the CO₂ economy were touched on and discussed during the closing debates on both days of the conference. All the speakers agreed that all activities in the field of Carbon Capture and Sequestration (CCS) should be reconsidered and budgets re-directed to Carbon Capture and Utilization (CCU). The CCU concept is an important prerequisite for starting a commercially successful CO₂ economy. Another point that emerged very clearly from the discussions is that although the quantities of CO₂ that can be used as feedstock for chemistry and polymers are small in comparison to the net CO₂ emissions worldwide, this strategy must be followed and coupled to the use of renewable energy sources in order to reduce our dependence on depleting fossil resources, especially in regions such as Europe where resources are scarce. Other topics focused on public acceptance and communication, as well as a suitable political framework, for example opening the Brussels Renewable Energy Directive (RED) to CO₂ fuels.

Michael Carus, Managing Director of nova-Institute, presented his long-term vision for the CO₂ economy: “The vision of a world powered by solar material and fuel, splitting water using sunlight and CO₂ to produce material and fuel (and even feed and food) and oxygen. A world powered by artificial photosynthesis, in which increasing proportions of human-engineered structures operate like trees to feed the demands of industry and society, will lead to a really sustainable world.”

Due to the extremely positive feedback on this initiative, nova-Institute will organize the next CO₂ conference in 2013, where the leading players in this field will have another chance to meet and discuss their latest technological developments. However, the next conference will be held for three days to cover the wide range of topics in the CO₂ economy. The conference will once again take place in the Haus der Technik in Essen from 14th to 16th October 2013.

The conference proceedings will soon be available. They are free of charge to all participants and cost €150 for non-participants. Please visit www.co2-chemistry.eu

The picture shows the discussion at the end of the first conference day, photograph: nova-Institute 2012

Download link:

http://co2-chemistry.eu/media/images/12-10-10_CO2-Conference_Podium.jpg

Podium from left to right: Dennis Krämer, Dechema e.V, Germany / Dr. Harald Strittmatter, Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB, Germany / Prof. Dr. Michele Aresta, University of Bari, National Consortium on Catalysis (CIRCC), Italy / Sven Petersen, Linde Engineering Dresden GmbH, Germany / Prof. Dr. Peter Styring, University of Sheffield, UK / Cor Koning, DSM Coating Resins, The Netherlands / Dr. Sarah Wallus, RWE Power AG, Germany / Dr. Guido Meurer, Brain AG, Germany / Prof. Dr. Arno Behr, University of Technology Dortmund, Germany / Michael Carus, nova-Institute, Germany (Organizer)

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