

April 6, 2016

Fuel from sunlight - carbon dioxide, water and green electricity as building blocks for sustainable chemistry

DIFFER, Eindhoven University of Technology and Syngaschem BV start (Chemical) Industrial Partnership Programme in the joint laboratory SynCat@DIFFER at Eindhoven.

Richard van de Sanden (Director DIFFER), Erwin Kessels (Professor of Physics, Eindhoven University of Technology) and Kees-Jan Weststrate (Syngaschem BV) have been granted a substantial subsidy to make liquid fuels from green electricity, water and carbon dioxide. They will work together to gain understanding of the fundamental principles behind this form of fuel production. To enable the collaboration, Syngaschem BV teams up with two funding agencies, the Foundation for Fundamental Research on Matter (FOM) and the Netherlands Organisation for Scientific Research (NWO) – Chemical Sciences in this Industrial Partnership Programme with a total budget of approximately 1.6 Million Euro. The program also foresees in close international collaboration with the SynCat@Beijing laboratory of Synfuels China Technology.

Due to the rapid growth of green electricity production there is a need for chemical processes that can use electricity instead of fossil raw materials. For example, this is relevant for the large-scale use of sustainable, fluctuating energy sources such as wind turbines and solar panels. By converting temporary electricity surpluses into liquid fuel, a sustainable energy infrastructure is created.

The researchers from the Netherlands Institute for Fundamental Energy Research DIFFER, the Department of Applied Physics at Eindhoven University of Technology and the company Syngaschem BV are joining forces to efficiently convert green electricity into liquid hydrocarbons with a high energy density, such as gasoline or diesel.

Kees-Jan Weststrate (Syngaschem BV, project manager) explains: "If we can understand this specific form of fuel production then at the same time we will also create opportunities for the production of other high-value chemical products. Products based on carbon are an indispensable part of our society and with this approach we can continue to produce those chemicals without a need for fossil sources."

Michail Tsampas (group leader at DIFFER) adds: "Effective utilization of CO₂ waste is expected to preserve atmospheric quality and limit climate changes, while our proposed methods will not affect the food chain or lead to indirect changes in land use."

DIFFER director **Richard van de Sanden** is pleased with this new collaboration: "The large-scale and efficient storage of sustainable energy is what the energy transition is all about. How do we ensure that clean energy is available when and where the user needs it? Many concepts exist but these often still have a low yield. Fundamental research in collaboration with industry is needed to improve the yield. Only then will you know for certain that you are addressing the right challenge to make the large-scale application of your idea possible."

At the boundary of chemistry and physics

The research has both chemical and physical aspects: partners are active in the area of electrochemistry, catalysis, surface reactions, spectroscopy and plasma physics. NWO Chemical Sciences (CW) and the

Foundation for Fundamental Research on Matter (FOM) therefore sought collaboration and a multidisciplinary research programme has been realised: a mix of an Industrial Partnership Programme (IPP) from FOM and a Chemical Industrial Partnership Programme (CHIPP) from NWO CW.

Top Sector Chemistry & Energy

The research falls within the scope of the Top Sectors Chemistry and Energy, and the Innovation Fund Chemistry (IFC) of CW - an instrument through which NWO is contributing to the Top Sector Chemistry.

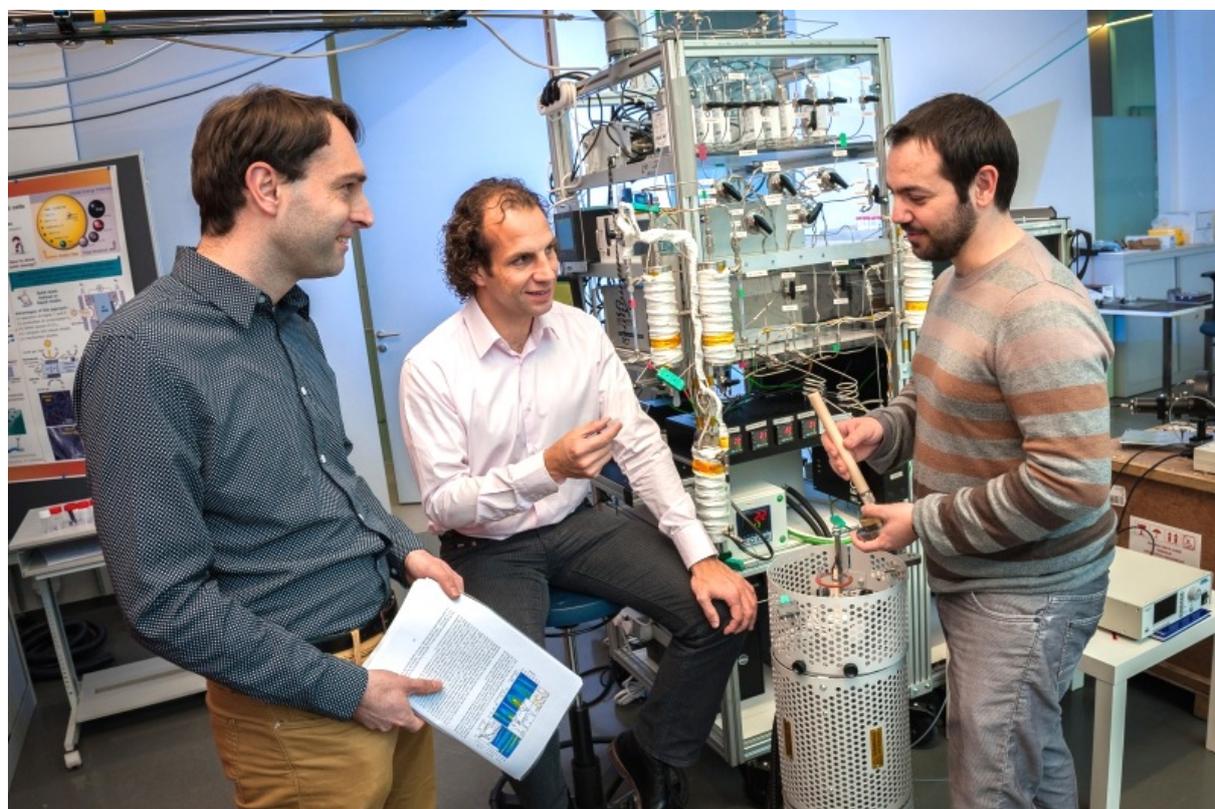
More about the partners

In the (CH)IPP programme, the Dutch Institute for Fundamental Energy Research DIFFER and the research group Plasma and Materials Processing (PMP) of Eindhoven University of Technology are joining forces with the research company Syngaschem BV.

DIFFER (www.differ.nl) is part of FOM and NWO and its mission is to realise and support research into the energy of the future. DIFFER's two main themes are sustainable energy production from nuclear fusion and large-scale storage of sustainable energy in the form of solar fuels.

The research group PMP of Eindhoven University of Technology is specialised in techniques that allow physical and chemical processes to take place efficiently on surfaces, especially applications in the area of sustainable energy generation and energy storage.

Syngaschem BV (www.syngaschem.com) is a private Dutch research company founded in 2013 by professor **Hans Niemantsverdriet**. Since January 2016 it has been located in the DIFFER building at the Eindhoven University of Technology campus. The mission of this new **SynCat@DIFFER** laboratory is the storage of green electrical energy in the form of clean fuels, with the key steps being the formation and conversion of synthetic gas (syngas). Syngaschem BV aims to acquire a fundamental understanding of these processes as a catalyst for technological breakthroughs. Syngaschem BV is research partner of **Synfuels China Technologies Co. Ltd.**, a spin-off company of the Chinese Academy of Sciences that is leading the way in China in clean coal-to-liquids technology, where Hans Niemantsverdriet leads their new fundamental catalysis laboratory **SynCat@Beijing**.



Researchers Kees-Jan Weststrate (Syngaschem BV), Erwin Kessels (Eindhoven University of Technology) and Michail Tsampas (DIFFER) (from left to right) are working together on the conversion of sunlight into fuel. Photo: Bram Lamers / DIFFER.