Background

The TOPSØE CATALYSIS FORUM was created as a framework for an open exchange of views on catalysis in the fields of interest to Haldor Topsøe. The forum is conceived as a platform for discussions of new reactions and new principles of catalysis in an attempt to jointly look beyond the horizon. In order to facilitate an open debate and to enable all participants to make use of the information received during the meetings in their future work, the forum is held on a non-confidential basis. The TOPSØE CATALYSIS FORUM works through individual contacts and annual meetings focusing on a single topic.
The topic of the 8th TOPSØE CATALYSIS FORUM is:

Catalysis and future energy

Energy is the key to our living and the sun is the most important supplier. Taking into account the foreseeable increased standard of living and the growing world population the demand for energy and chemicals will increase until 2030 and beyond. The scarcity of fossilized sun energy (oil, natural gas, etc.) in combination with the problematic increase of CO_2 concentration in the atmosphere will force the world's present energy structure towards sun generated short-lived energy forms. These energy forms also include photosynthesized bio chemicals - energy forms that are stored for a short time or even used immediately. Electricity is one promising energy carrier but sun generated electricity, energy from wind, photovoltaic and thermal power will be out of phase with the demand thus forcing chemical and electrochemical processes to be developed for storing this outbalanced energy as a chemical compound in fuels or as electrode compounds in batteries. The outbalanced energy even open up for a new (electro-)chemistry that synthesizes fuels as methanol, DME and methane out of CO_2 thus alleviating the greenhouse problem. Out of the earth's solar influx of 580 TW only around 1% is used for photosynthesis of plants and out of this only a minor energy fraction is used for synthesis of bio fuel compounds such as glucose, sugar or precursors for commodity chemicals. Improvement of plants' "chemical yield" or the photosynthesis (bio)chemistry routes themselves can contribute to solar energy efficiency and CO_2 utilisation. Also the efficiency of photovoltaic materials will be improved. The transition path to this sustainable energy structure requires development and utilization of a number of energy efficient selective chemicals and electrochemical processes and this will inescapably require the assistance of catalysts. Thus this seminar will cover catalyst developments within the following main topics:

- Photogenerated voltage
- Optimized and artificial photosynthesis for biomass and chemicals
- Energy storage routes and chemistry
- Potential of future batteries and related electro catalysis
- Biomass to fuels and chemicals
- Electricity to fuels and chemicals

The aim of this seminar is to discuss current and future catalytic processes for energy conversion, fuels and storage. The open-minded and informal atmosphere for sharing knowledge and ideas offered by the forum provides a basis for new understanding and innovations within this field.

Scientific committee

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Topsøe Catalysis Forum

Catalysis and future energy

Munkerupgaard 25-26 August 2011

RESEARCH | TECHNOLOGY | CATALYSTS

HALDOR TOPSØE
CATALYSING YOUR BUSINESS

Programme

The TOPSØE CATALYSIS FORUM is organised as a two-day topical meeting. The first day is devoted to overview lectures which set the scene and form the basis for the discussions. On the second day, the discussions and exchange of views will take place in three groups, each organised around a specific sub-topic.
Participation is by invitation only. Besides the presenters, representatives from industrial collaboration partners are invited, but the majority of the participants are Haldor Topsøe staff. On the first day of the meeting, up to 70 participants will be present whereas about 50 will take part in the discussions on the second day. The meeting is held on a non-confidential basis.

Wednesday, 24 August

12:00-15:35 Visit to the Haldor Topsøe Headquarters

19:00 Buffet at Munkerupgaard

Thursday, 25 August

07:30-09:00 Breakfast and arrival of local participants

09:00-09:10 Welcome address, Jesper Nerlov, Haldor Topsøe

Plenary morning session - chairman: Kim Grøn Knudsen, Haldor Topsøe

09:10-10:00 **Imaging catalysis and photosynthesis where human ingenuity supersedes evolution**
Thomas Moore, Arizona State University

10:00-10:50 **Direct catalytic conversion of biomass to biofuels, or C3Bio**
Fabio H. Ribeiro, Purdue University

Coffee break

11:10-12:00 **Fuels by (photo-) electrocatalysis**
Jens K. Nørskov, Stanford School of Engineering

Lunch

Plenary afternoon session - chairman: Glen Hytoft, Haldor Topsøe

13:30-14:20 **Electrolysis for synthetic fuel production**
Carl Stoots, Idaho National Laboratory

14:20-15:10 **Li-ion and beyond**
M. Stanley Whittingham, State University of New York

Coffee break

15:30-16:20 **Photovoltaics**
Ole Hansen, Technical University of Denmark, Dept. of micro- and nanotechnology

19:00 Conference dinner

Friday, 26 August

07:30-08:45 Breakfast

08:45-09:00 Introduction to group discussions, Joakim Reimer Thøgersen, Haldor Topsøe

09:00-12:00 Group discussions

Grp. 1: Future utilisation of biomass
- chairman: Poul Erik Højlund Nielsen, Haldor Topsøe

- **Future production of biomass for fuel and chemicals**
  Claus Felby, University of Copenhagen
- **Strategies for catalytic carbohydrate conversion**
  Esben Taarning, Haldor Topsøe
- **Some catalytic challenges in the production of chemicals from biomass**
  Robert J. Davis, University of Virginia

Grp. 2: Electrochemically assisted fuel production
- chairman: Claus Friis Pedersen, Haldor Topsøe

- **Electrochemical fuel production**
  Marc Koper, Leiden University
- **CO_2 electrolysis**
  Søren Højgaard Jensen, Risø DTU, National Laboratory for Subtainable Energy
- **Semiconductors and catalysts for the production of solar fuels**
  Thomas F. Jaramillo, Stanford School of Engineering

Grp. 3: Batteries of the future
- chairman: Keld Johansen, Haldor Topsøe

- **Status on the development of Li-air batteries**
  Lutgard C. De Jonghe, PolyPlus Battery Company
- **Li-ion batteries: Developments and their future potential**
  Josh Thomas, Uppsala University
- **Identifying the rate-limiting processes at the Li-air cathode**
  Tejs Vegge, Risø DTU, National Laboratory for Subtainable Energy
- **The non-aqeous Li-air battery: Promise and challenge**
  Alan Luntz, Consulting Professor, SLAC Stanford University

Closing session - chairman: Henrik Topsøe, Haldor Topsøe

12:00-13:00 **BP energy outlook to 2030**
Bruce Cook, BP Products North America

Lunch between 13:00 and 14:30