



ΙΤΕ/ΙΕΧΜΗ

ΣΕΜΙΝΑΡΙΟ ΣΕΜΙΝΑΡΙΟ

ΟΜΙΛΗΤΡΙΑ: **Niels J. Bjerrum**, Professor
Department of Energy Conversion and Storage
Technical University of Denmark, Denmark

ΘΕΜΑ: **A "new" molten salt system: H_2O-MPO_3 (M= Li, Na, K, Rb, Cs) for water electrolysis**

ΤΟΠΟΣ: Αίθουσα Σεμιναρίων ΙΤΕ/ΙΕΧΜΗ

ΗΜΕΡΟΜΗΝΙΑ: **Τρίτη, 27 Σεπτεμβρίου 2016**

ΩΡΑ: **12:30**

ΠΕΡΙΛΗΨΗ

Proton-exchange membrane (PEM) water electrolysis technologies, which are characterized by high current densities are expected to become an important part of "the hydrogen energy cycle", where water is split into hydrogen and oxygen, using renewable energy sources (excess energy storage). The hydrogen can be used in fuel cells or converted to other fuels. In contrast to the state of the art and in order to overcome important limitations of the present technology, the goal is to go to higher temperatures and to develop intermediate temperature (150-400 °C) PEM water electrolyzers. The higher temperature will result in higher conductivity, smaller over-potential and improved thermodynamics.

The electrolysis cells using steam from industrial sources will work as continuous flow reactors, and can also be used for co-electrolysis of water vapor with gases such as carbon dioxide and thus for direct electro-synthesis of fuels.

As can be expected and has been proven (proof of principle) by us, the higher temperatures can change the material pool from expensive noble metal compounds for electrodes and electro-catalysts to new less expensive ones. Tungsten carbide, WC, has



ITE/IEXMH

been shown to be a better catalyst than platinum for hydrogen reduction reaction (HER) at 260°C. New electrolytes are being developed based on H₂O-MPO₃ (M= Li, Na, K, Rb, Cs) proton-conducting supported liquid phases (SLPE). These systems are unique because of their simplicity, high electric conductivity and thermal stability.

Niels Janniksen Bjerrum

- 2012 Professor at DTU Energy Conversion
- 2012 Head of Section at DTU Energy Conversion
- 2010-13 Head of Danish-Chinese Center for Intermediate Temperature Proton Conducting Systems (PROCON).
- 2007-11 Head of Center for Renewable Hydrogen Cycling.
- 1999 - Chairman for the Society of Professors at DTU
- 1998-12 Professor in Inorganic Materials Science at Department of Chemistry, Technical University of Denmark.
- 1996 Received The 1996 Max Bredig Award in Molten Salt Chemistry in Los Angeles, California.
- 1995- Foreign Member of The Norwegian Academy of Technological Sciences.
- 1994 Cofounder of Danish Power Systems (Director 1994 – 2003)
- 1994 Awarded The Højgaard & Schultz Jubilee Prize.
- 1992-93 Accepted for Professorship in Inorganic Chemistry, University of Odense, Denmark.
- 1992 Foreign Member of The Ukrainian Academy of Sciences.
- 1991- Chairman of the Board of Ellen and Niels Bjerrum Prize in Chemistry
- 1989-98 Reader ("Docent"), Chemistry Dept. A, Technical University of Denmark
- 1988 Adjudged qualified as a Professor in Chemistry, University of Odense, Denmark.
- 1984 Adjudged qualified as Professor in Inorganic Chemistry, DTU
- 1982- Founder and Secretary of the Danish Academy of Natural Sciences ("Danmarks Naturvidenskabelige Akademi").
- 1982 Doctor of Science (Dr. techn.), Technical University of Denmark. Thesis entitled "The Chalcogens in Chloroaluminate Melts".
- 1979 Awarded the Ellen and Niels Bjerrum Prize in Chemistry
- 1976 Awarded Honorary Prize of the Ole Rømer Foundation.
- 1971-89 Associate Professor, Chemistry Dept. A, Technical University of Denmark.
- 1967 Postdoctoral appointment, Oak Ridge National Laboratory, USA.
- 1966-71 Assistant Professor (Amanuensis), Chemistry Dept. A, DTU
- 1964-66 Postdoctoral appointment, Oak Ridge National Laboratory, USA.
- 1964 Master of Science in chemistry, Copenhagen University.
- 1961-62 Exchange Scholarship study at University of Lund, Sweden.
- 1958 Undergraduate at University of Copenhagen.
- 1940 Born October 6th in Copenhagen, Denmark.



ITE/IEXMH

Academic Career

Over a number of years Niels J. Bjerrum has built up a research group active in the fields of inorganic chemistry, electrochemistry, molten salt chemistry, catalysis, energy and materials chemistry. It is today internationally acknowledged; for example, more than 70 scientists from abroad have over an extended period carried out research within the group.

N. J. Bjerrums combined list of publications, patents and special lecture presentations involves more than 600 items, including more than 200 publications in major critically reviewed international journals with more than 7000 citations and a h-index of 38 (Web of Science).

Niels J. Bjerrum has been the senior advisor for 42 completed Ph.D. studies. N.J. Bjerrum has twice been the chairman of a major international conference.

N. J. Bjerrum has frequently (21 times in all) acted as the official opponent of doctoral dissertations; also, on 15 occasions he has been chosen to be an expert judge on the board for the appointment of a professor, particularly at the Norwegian University of Science and Technology and DTU.

N. J. Bjerrum has taught at all levels at DTU.

Industrial and Technical Work

N. J. Bjerrums research activity has resulted in many invitations to take part in international cooperation and for example the EU have funded 16 of these projects, 8 of them with him as the coordinator. In addition he has taken part in more than 80 Danish collaborative projects involving many of the larger Danish companies such as Danfoss A/S, DONG Energy A/S, Grundfos A/S and Haldor Topsøe A/S.

N. J. Bjerrum has been named as an inventor in 18 patent applications. 8 of these have resulted in the granting of international patents.