

Title

Conjugated polymers as (photo)electro-catalysts

Bio

Prof. Bjørn Winther-Jensen joined The Department of Advanced Science and Engineering at Waseda University in 2015



Previous:

- Chemical engineer and PhD from The Technical University of Denmark.
- Research Engineer and Project Manager at NKT Research Centre, Denmark.
- Research Fellow, Materials Science and Engineering, Monash University 2006-2010.
- Associated Professor, Materials Science and Engineering, Monash University 2010-2015

His main research interests are focused on two areas within conjugated polymer thin films:

1) Research and development of conducting polymers with high (photo-) electro-catalytic activity using chemical oxidative polymerisation methods. This research reaches from the fundamental understanding of the charge transport mechanisms in and from conjugated systems to implementation of conducting polymers in devices for water splitting, fuel-cells and sensors.

2) Formation of conducting polymers composites where the 2nd component is enhancing the properties of the conjugated polymers or being a redox- or electro-catalytic centre in their own right.

Seminar Abstract

Photovoltaics and wind-power has become economical viable for production of electrical power. This is a very encouraging and needed development and the total capacity from these renewable sources are increasing with remarkable speed. However, ~75% of the world's energy consumption is in form of fuels rather than electricity and thus routes to produce fuels from renewable sources is rapidly becoming a main focus of research. Here the idea of producing fuel – in form of hydrogen – via water-splitting directly from sunlight is a very appealing possibility, which would indeed have significant environmental, economical and geopolitical consequences if realized in a simple and cost-efficient way. Most research in this area has been focusing on inorganic materials as light-absorbers and catalysts for photo-chemical water-splitting but we have recently reported the use of polythiophenes as combined light-harvester and catalyst for the hydrogen evolution reaction. However, the understanding of conjugated polymers function as (photo)electro-catalysts is not fully developed. The field is only about 10 years young and the interaction between conjugated polymers and water is non-trivial indeed !

Some of the fundamental issues will be discussed:

- What is the equilibrium potential of conjugated polymers ?
- Are conjugated polymers catalytic in the neutral or oxidized state – or both ?
- Where are the possible binding sites and how can we picture multi-electron reactions ?
- Is light excitation affecting the catalytic pass and the charge transfer to the target molecule ?