



# Battery activities at Haldor Topsoe A/S

RESEARCH | TECHNOLOGY | CATALYSTS

Meeting in Danish Battery Society, 1-3-2013

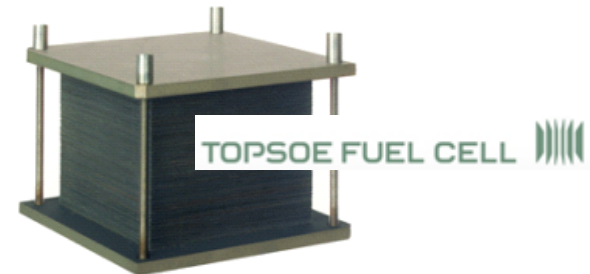
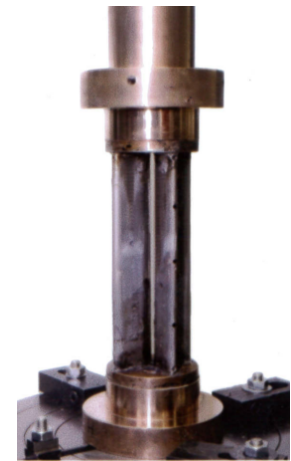
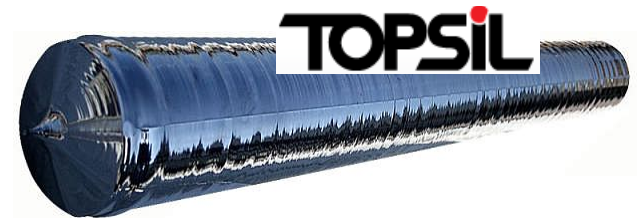
# Outline

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- A little history
- What we do and what our plans are
- Why battery materials?
- Activities and setup

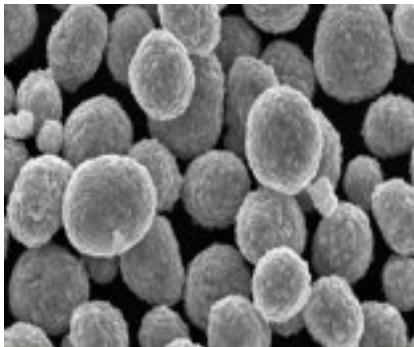
# Historical non-catalysis projects

- Single crystal silicon for silicon wafers through float zone technique. Crystallized in a factory and the company Topsil (no longer part of Haldor Topsoe).
- Super conductors development (1988-2002) which again used the float zone technique.
- Fuel cell development from 1989 crystallizes in Topsoe Fuel Cell (2003) owned by Haldor Topsoe
- There are others...



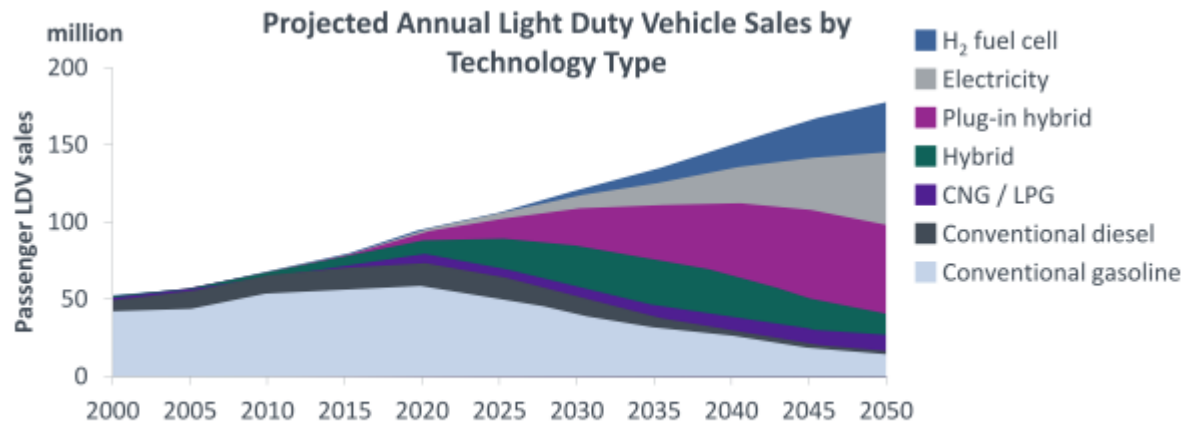
# What we do

- Development of electrode materials for Lithium ion batteries and/or new battery types.
- Focus on cathode material, but we also look into anode materials.
- Emphasis on quality, scalability, and prize.
- Will hopefully lead to a production line.



# Why do we go into battery materials?

- Sale of electrical vehicles is expected to increase the coming years.
- Demand for energy storage is increasing as renewable energy production increases.
- By 2015 the cathode material demand is expected to be 75000 ton/year.



Source: IEA Energy futures, BLUE Map scenario

# Why do we think that we can?

We already have expertise within:

- Materials properties related to morphology
- Material characterization
- Slurries, casting, and coatings
- Synthesis of similar material
- Large scale production of similar materials
- Surface science
- Bringing new products to the market



# Two locations

- Ravnholm: Research, business development, and future scale up-activities.



Keld  
Johansen



Line  
Holdt Rude



Kinson  
C. Kam



Jonathan  
Højberg



Ole  
Anker Hansen



Frederik  
Flemming

- Ulm: Research and collaboration with German partners.



Søren  
Dahl



Jon  
Fold von Bülow



Karen  
Wonsyld



# Why in Ulm?

- Much commercial and research activity on lithium ion battery in the area.
- Many companies (e.g. the car industry) with interest in batteries in South Germany.
- We share campus with ZSW – research institute with about 100 employees working with batteries.
- The Helmholtz institute is building a new research center for batteries close by.





# Partners and projects

- Project with AU and ZSW on titanate development for anodes.



- ReLiabLe: Project on lithium air batteries.



- HI-C: Project on in-situ studies of interfaces for obtaining high C rates.

# Materials research

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Nothing is yet set in stone, but we look into ....

- NMC, high voltage spinels e.g. LMNO, titanates,
- and new possibilities.
- Modifications of existing materials or new materials.
- Find cheaper synthesis routes.
- Looking at scale-up possibilities at an early stage.
- Adapting to market demands.

Thank you!

Questions!