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CHEM-E5145
New Material Solutions

Workshop 2
17.1.2019

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Workshop timetable

- 8.30-9.30 poster preparation
- 9.30-10 gallery walk with posters
- 10-10.15 Sum-up the posters

  Break 15 min.

Workshop atmosphere 2016

- 10.30-11.15 Why “New Material Solutions”

  Break 5 min.

- 11.20-11.45 Peer-review of Flip report + videos preparation

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Indentent learning outcomes Workshop II

Recognize state-of-the-art materials currently used in renewable energy systems

Share the expertise of ones field in a heterogenius team

Recognition why new material solutions are needed → Develop new material solutions and eco-designs

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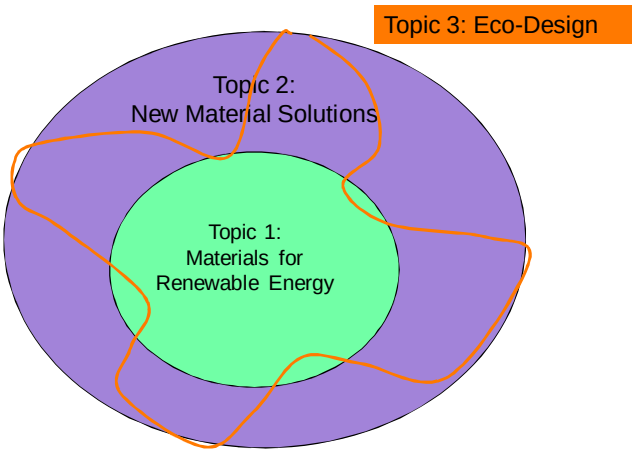

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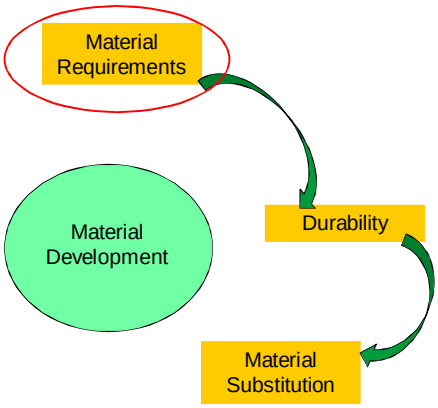
Topic 2 – New Materials Solutions



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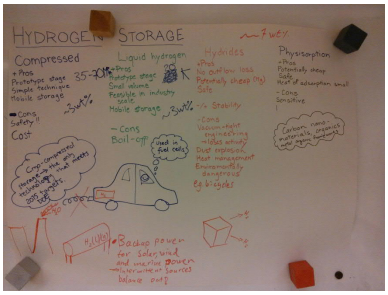
Flip Activity

Gather with your group (same topic)
You have 60 min. to discuss the material you read and prepare a poster

Large text (you prepare a video
And the poster should be
Understood from the video as well

Visualization



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Groups and Topics: Task 1 + 2

Group A
Off-Shore Wind
- Tuulia
- Katriina
- Veera
- Sai
- Konsta

Group B
Thermal Storage
- Marina
- Reima
- Riina
- Lucas
- Henna-Liisa

Group C
Flow Battery
- Henri
- Neea
- Veera
- Ella
- Marina

Group D
Solid Oxide Fuel Cell
- Nikhil
- Jarkko
- Aino
- Judit
- Julia

Group E
Concentrated Solar Power
- Verna
- Hamidreza
- Anna
- Lillian
- Efran

Group F
Marine
- Alexandra
- Karri
- Jacopo
- Jyrki

Continues…

Groups and Topics: Task 1 + 2

Group G
Solar PV
- Tomi
- Karim
- Irina
- Frej

Group I
"PEM electrolyser"
- Marko
- Sandesh
- Ahman
- Muhammad

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Flip Activity

- Poster tour
  - > Each of you will have your own team and you will teach the topic to others (5 min /poster)
  - Make questions, what did you not understand! (if not don't know – ask teacher or make a post-it tag to the poster
- Poster's and their presenting is evaluated
  - You all vote for the best poster (clear message)
  - The best posters get's automatically 4 p./workshop
  - Others get evaluated by the teachers 0-4 p. depending on the video posting (peers + teachers)

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Workshop II - Poster

The poster should include:

What is the application
How does this application function?
What are the advantages/disadvantages of this application?
What are the materials used in this application?

Technology Readiness Level (TRL) – Discuss in your group

Visualization –
to support understanding

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Technology Readiness Level (TRL)

By European Union, Horizon 2020

- TRL 1 – basic principles observed
- TRL 2 – technology concept formulated
- TRL 3 – experimental proof of concept
- TRL 4 – technology validated in lab
- TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7 – system prototype demonstration in operational environment
- TRL 8 – system complete and qualified
- TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

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Best Poster selection

Vote for the best poster!

Yellow ones for the TEAM As
Red ones for the TEAM Bs

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Summing up the posters

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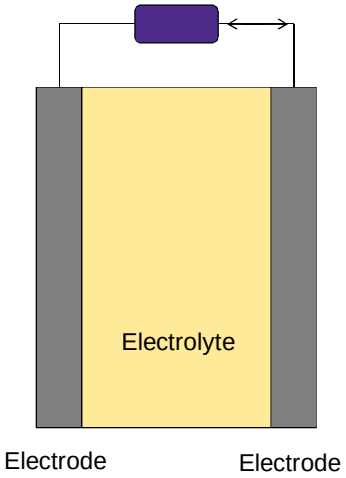
Electrochemical device



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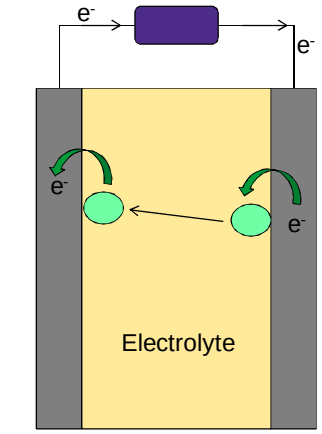
Electrochemical device



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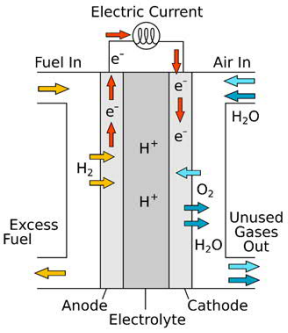
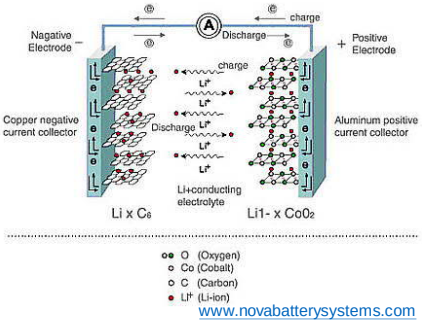
Electrochemical Systems

Fuel cell



en.wikipedia.org

Li-ion battery



www.novabatterysystems.com

1) Active materials – electrode materials
2) Electrolyte – conducting the ions between the electrodes inside the cell
3) Supportive materials – all other

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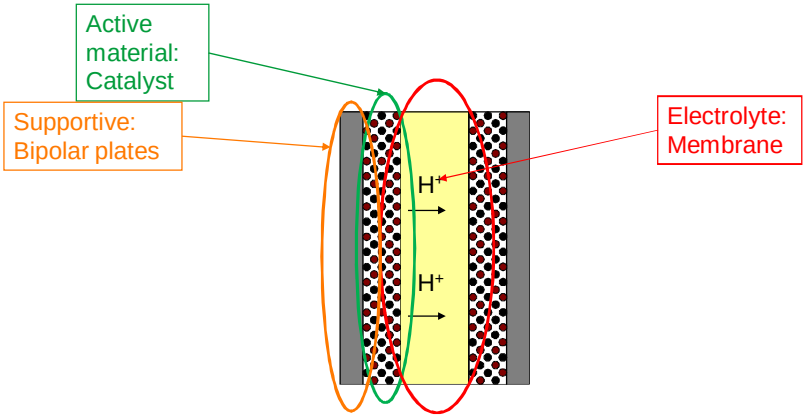
Different components in energy systems
Example Fuel cell



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Sum up from the poster's

Which of the applications are electrochemical devises?

Which of the applications have active materials?

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Difference in materials – electricity production

- Active materials
  - Catalyst (TiO_2 – Pt)
  - Directly relates to efficiency
- Wind mills, mechanical device – no active materials involved

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Sum up from the poster's

For the applications that have
ACTIVE MATERIALS

Efficiency of these systems is directly depended on the material development
- > Material Intensive

For the other application, only small improvements
(that is why biofuels/carbon fuels are not part of the course)

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Break 15 min.

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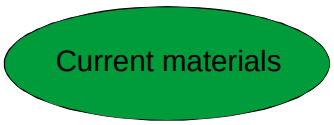
Challenges with materials

- Mind Map
  - What are the challneges in current energy system materials?
  - Examples



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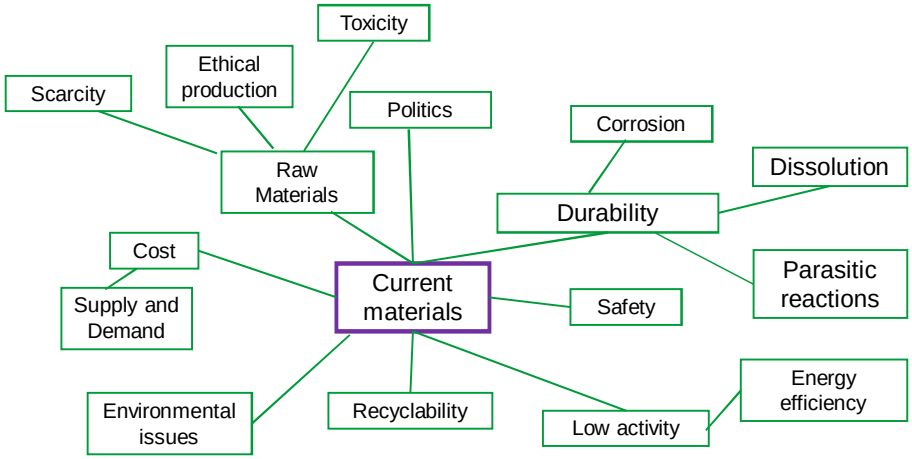
Challenges with materials



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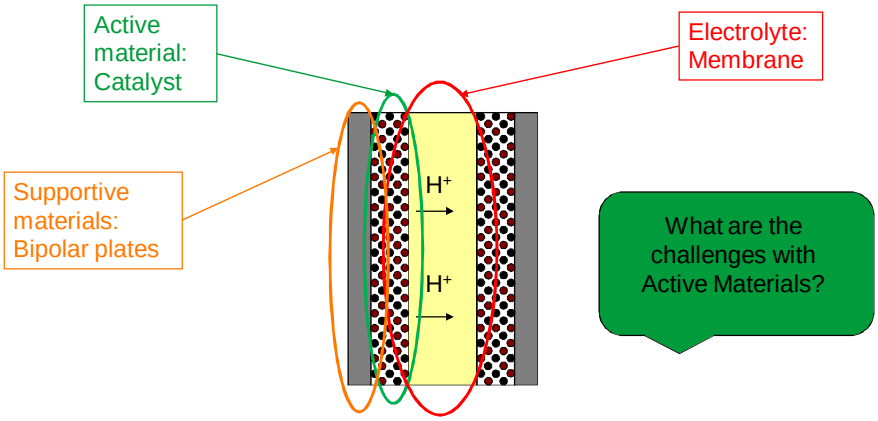
Mind map 2018

Different components



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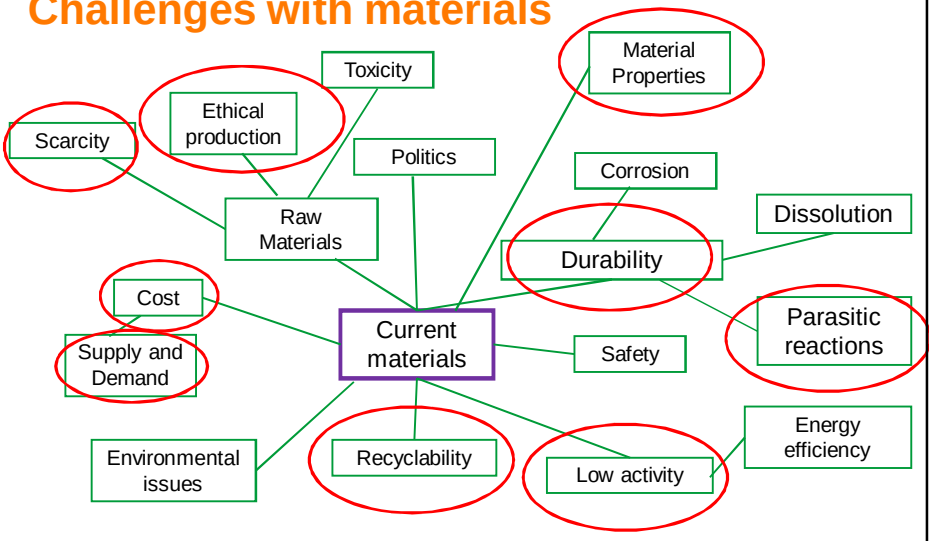
Challenges with materials



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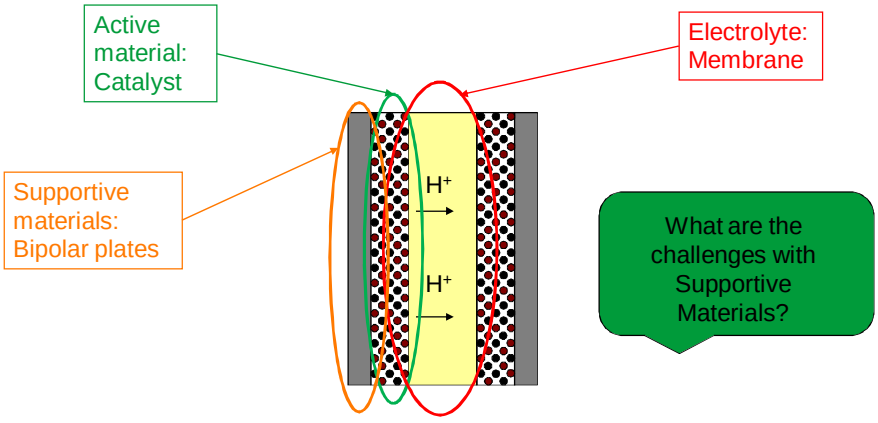
Mind map 2018

Development for active materials

Different components



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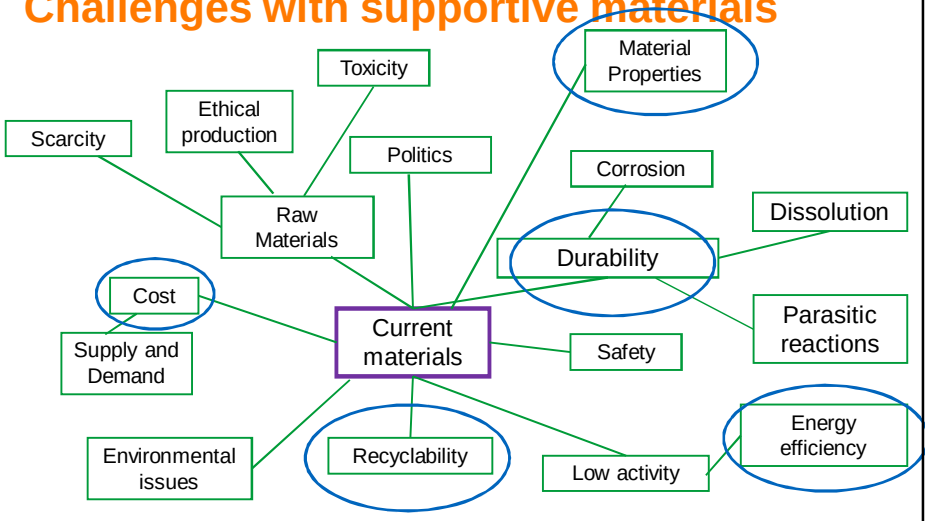
Challenges with supportive materials



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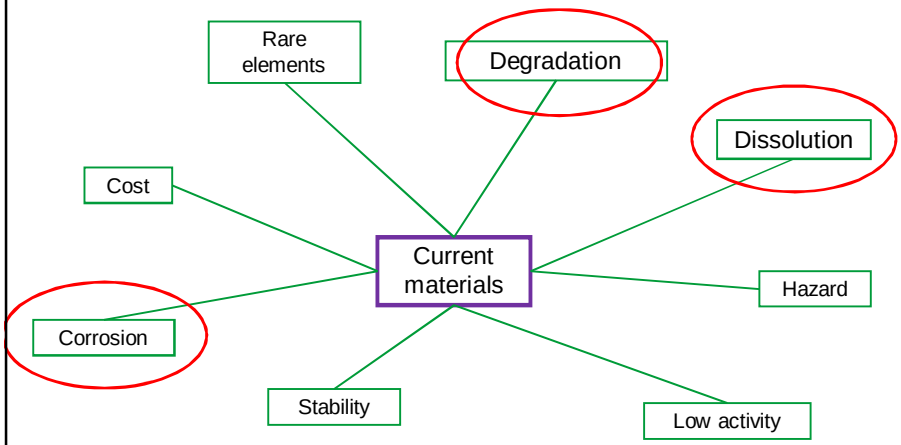
Mind map 2018

Development for supportive materials

Challenges with supportive materials?



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Development for supportive materials

New Material Solution (NMS)

New Material Solution

is not always

A New Material

Often application of known materials or their combinations to create

New Features

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New Material Solution (NMS)

New Material Solution

designed

For each application

- Costfull
- No tabulated data
- Stability and long-term properties are not exatly known
- Limited standards

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Developing materials

- Mind Map
  - How can we create new features on materials?

Material Development

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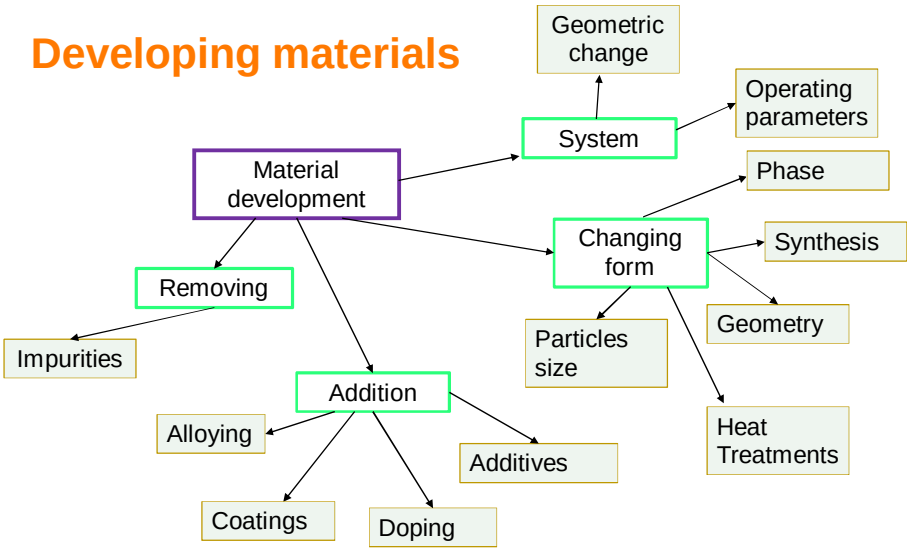
Developing materials



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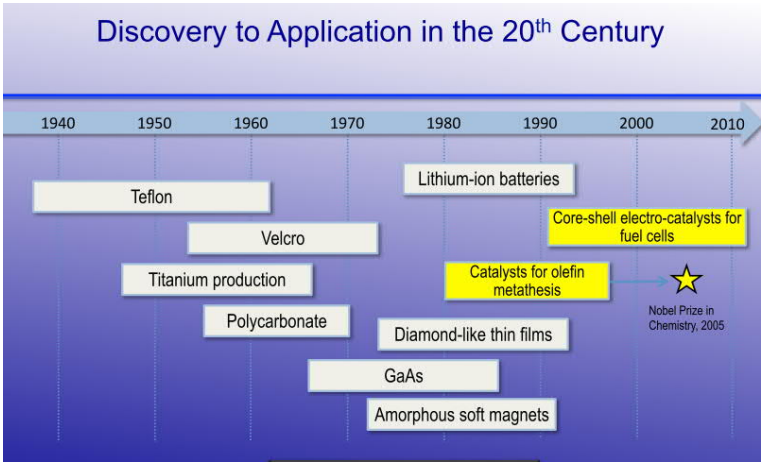
Mind map 2018

Discovery to Application



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After Gerd Ceder (MIT); materials information from T. W. Eagar and M. King, Technology Review 98 (2), 42 (1995).
Catalysis information from R. Schrock et al. and R. Adzic et al.

Discovery to Application

What are the steps?

Prepare timeline

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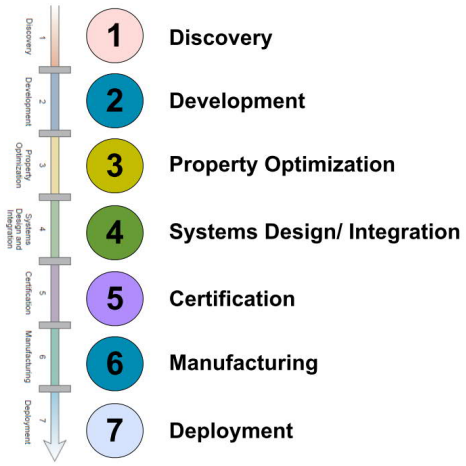
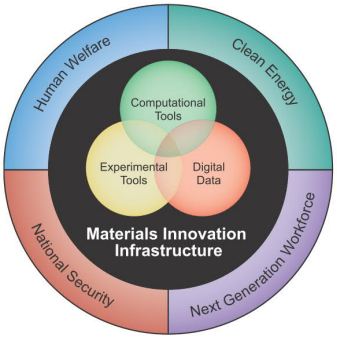
Discovery to Application





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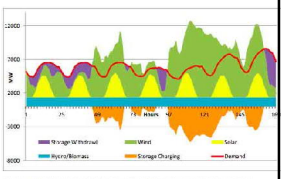
The Materials Genome Initiative, 2012

Summary



- Renewable energy materials
  - > Some challenges -> new materials needed
  - > Unsolved Material Issues
  - > How to make customers to believe in these issues?
- Developing new materials
  - What can be done (active materials versus non-acitve)
- Discovery to application is long

www.sonymobile.com

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Reflection

1. What was most interesting today?
2. I would have wanted to hear more on?

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Next workshop III

- What are the recent New Material Solutions in your application?
  -> Next week Poster's
  -> Find NEW (2018-2019) material development
- Theory part for next week: the different degradation mechanism of these components

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Flip report II:

1) Material Development in LIB_2013.pdf ALL STUDENTS
MyCoursese – Materials – Material Development

2) Paper clip: "Material Development"
Preferable in your application (if not found any on course topic)
(any country, any language)

3) Journal Paper: "New Material Solution" your application
(Each student should have a different paper, communicate this)

You can coordinate that you would not have same journal paper:
For instance agree who will have some on
- Active material (Anode + Cathode)
- Electrolyte
- Support material …

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Break 5 min.

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Setting up - Important dates

- Task 3 presentations
- Excursion to VTT (at week 7?)

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Flip reports – peer review

- Student number to your task
- Select one flip that is from other topic than your own
- Read and evaluate the report (15 min.)
- Write at least 2 sentence of feedback
  - What was good/interesting or/and what could be improved
- Grade
  - 3 p. Excellent work
  - 2 p. Good work
  - 1 p. Some parts missing/ Unclear text
  - 0 p. No submission

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At the same time, possibility to film your poster
-> insert to Wiki page

Preparing video on your poster

- Student number to your task

- Select one flip that is from other topic than your own
- Read and evaluate the report (15 min.)
- Write at least 2 sentence of feedback
  - What was good/interesting or/and what could be improved
- Grade
  - 3 p. Excellent work
  - 2 p. Good work
  - 1 p. Some parts missing/ Unclear text
  - 0 p. No submission

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At the same time, possibility to film your poster
-> insert to Wiki page

Task 1

- How long do you need to operate a device to obtain the energy that was needed to produce the raw materials in the device?

The DL for this submission is 18.1 at 9.15 am
Submitted to MyCourses

Task 1 gives you both max. 10 p. and both team members will get same amount of points!

2 Groups will work with a same topic, but should work independently (and not to come a same conclusion)

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Task 1

- Prepare a power point presentation
  - Template available at MyCourses – Assignments
  - All the **Assumption** that were made for the calculations
  - List of State-of-the-art materials and how much you need them
  - Step by step write down the calculations
  - All the values are marked with a reference number, (you can put all the references at the last slide)
  - Submit to MyCourses (each team member own submission, same file), everyone responsible on their own submission

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