

Module B1: New Material Solution

**AAE-E3120 Circular
Economy for Energy Storage**

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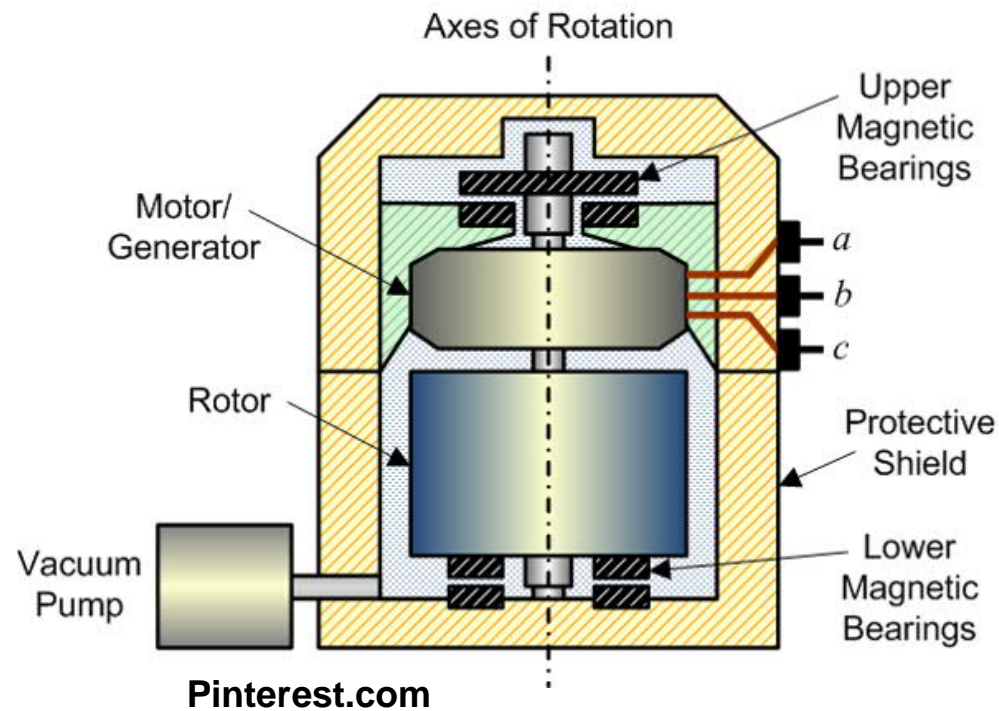
**Aalto University
School of Engineering**

Learning outcomes

- **Recognize the material choices**
 - What are limits for the material selection for these applications
- **Introduction to different material types used in ES systems**
- **Discover how the new material solutions are performed and what is the approach for material development**

Different materials needed for Energy Storage systems

Mechanical systems

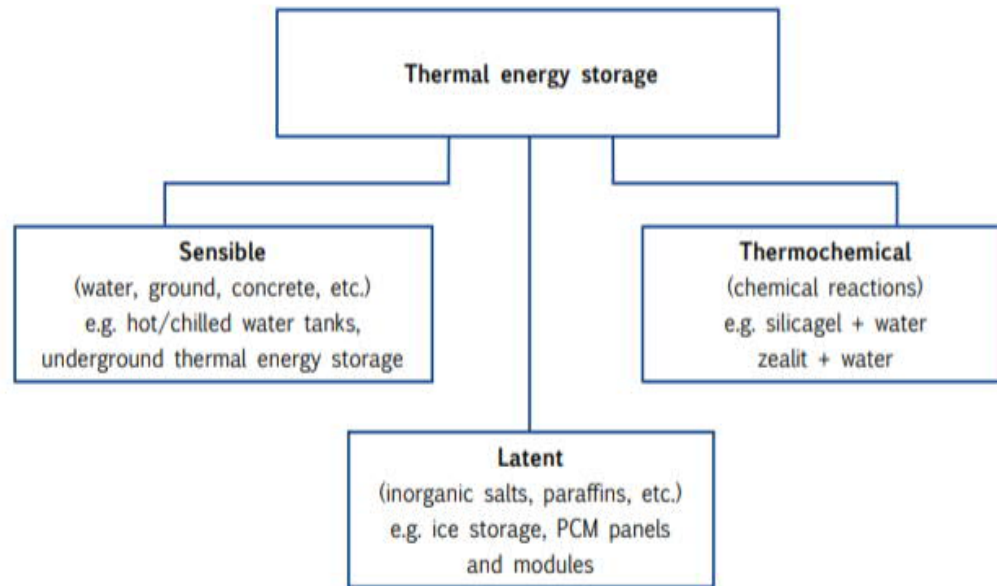


Fly wheels

Minimizing friction

- Materials tolerance
- Coatings
- Compatibility

Thermal materials

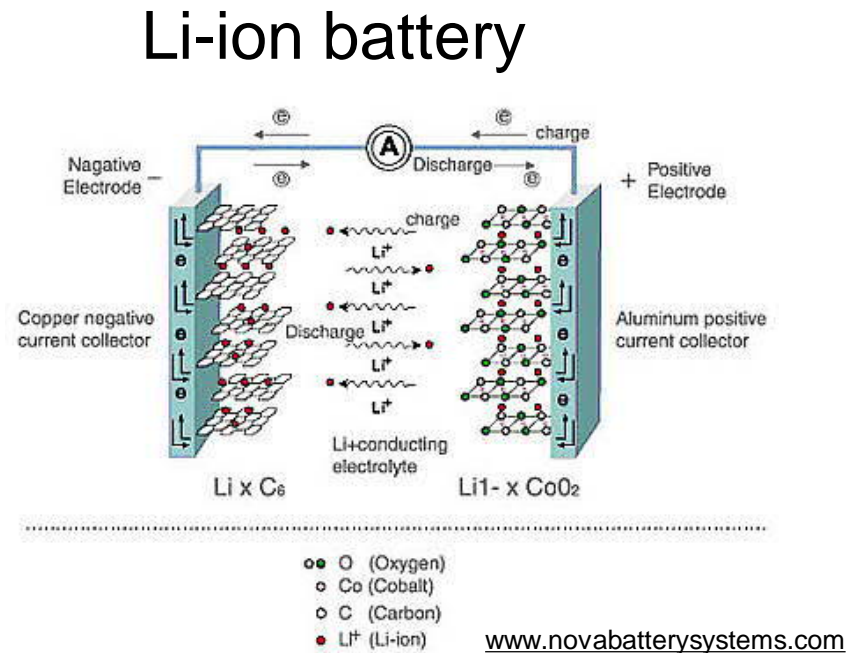
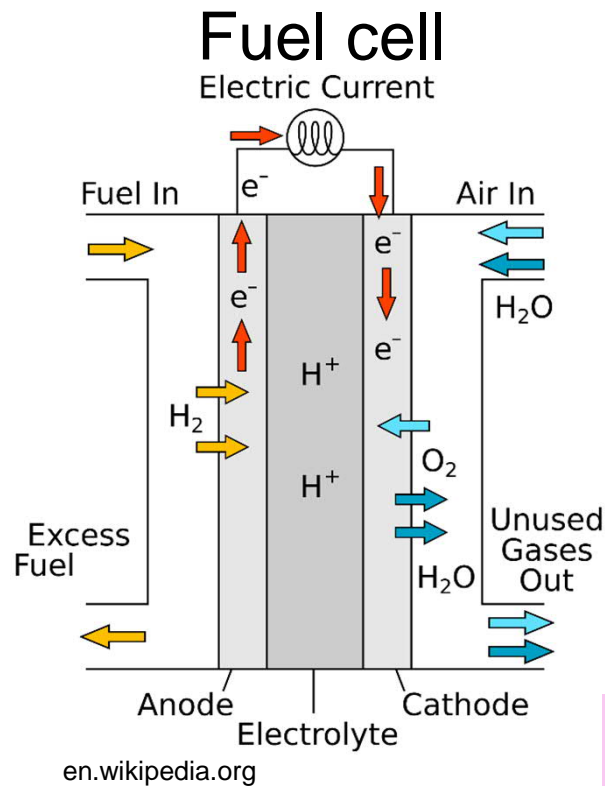


Thermal material

Finding suitable storage material

- **Storage material**
 - Properties
- **Supportive materials**
- **Coatings**

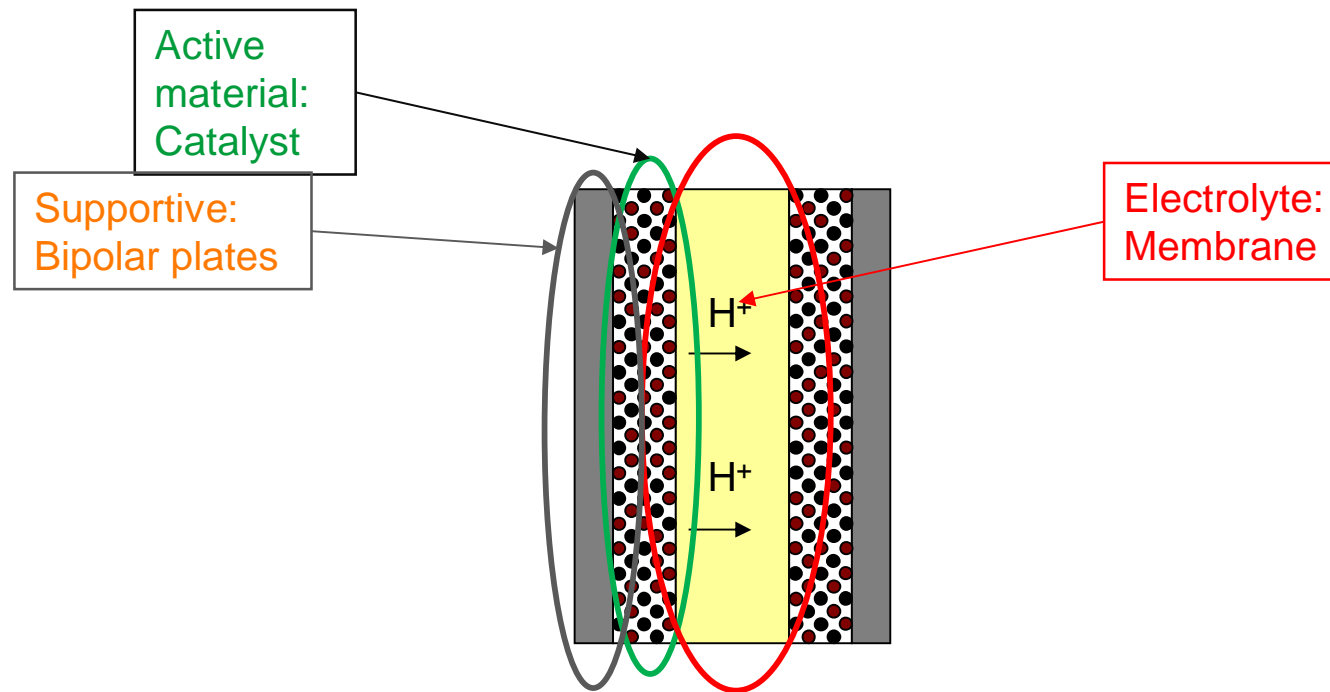
Electrochemical systems



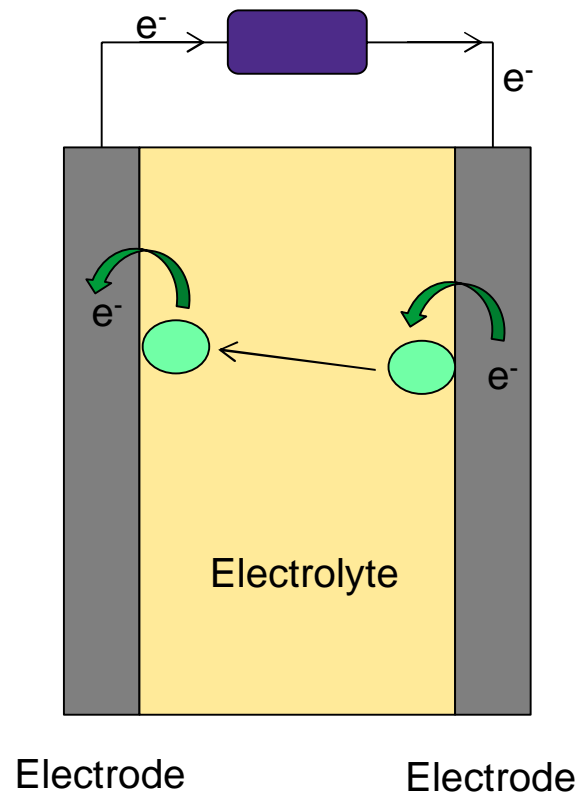
- 1) Active materials – electrode materials
- 2) Electrolyte – conducting the ions between the electrodes inside the cell
- 3) Supportive materials – all other

Electrochemical systems – where

Case: PEM Fuel cell



Electrochemical systems – operation, Case: PEM Fuel cell



Material development to increase performance

Different needs for **each application**
(posters 1)

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

Challenge with the current materials

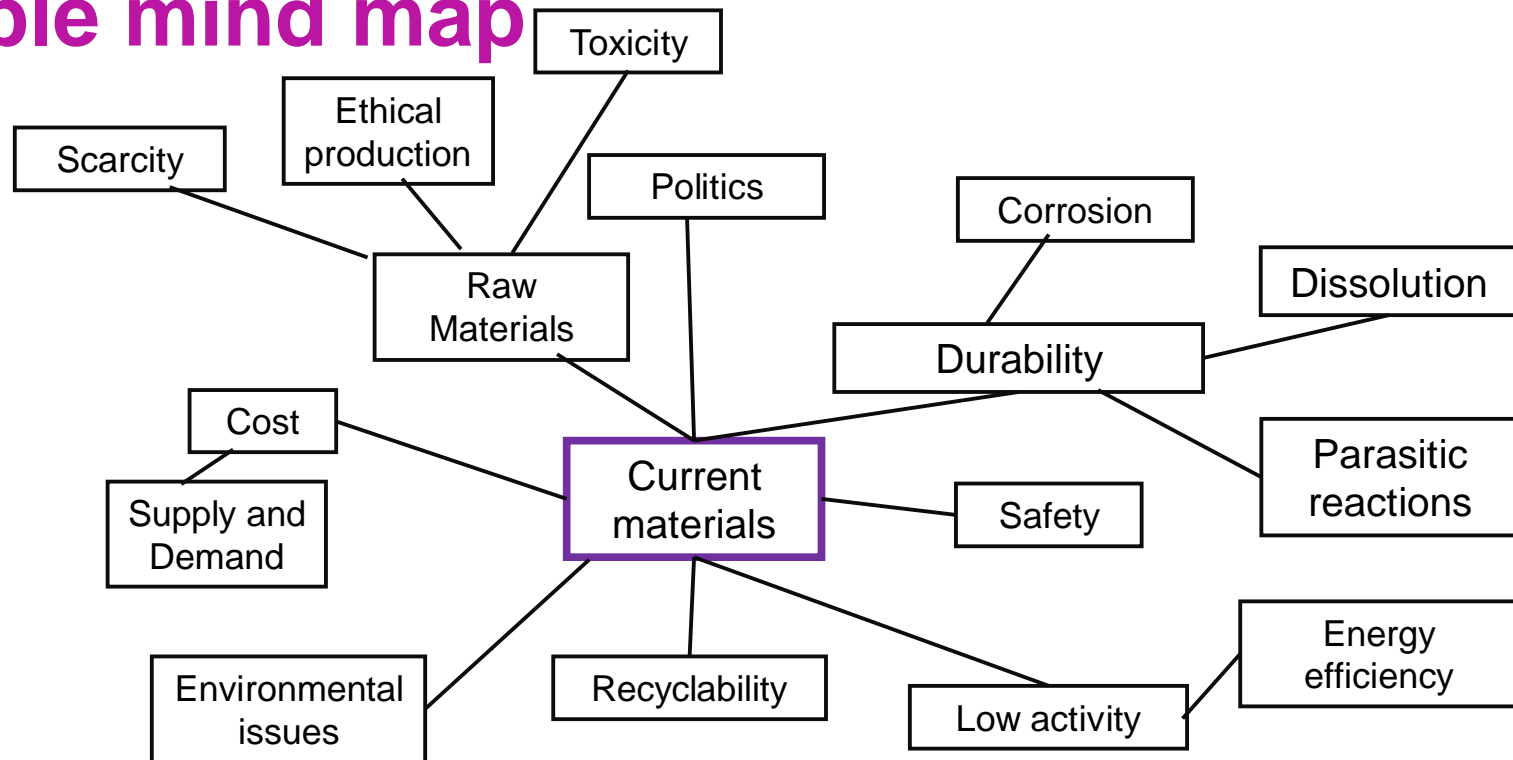
Challenge in current materials

Lecture Journal

Think of possible current challenges on these ES application
(Mind map or a list)

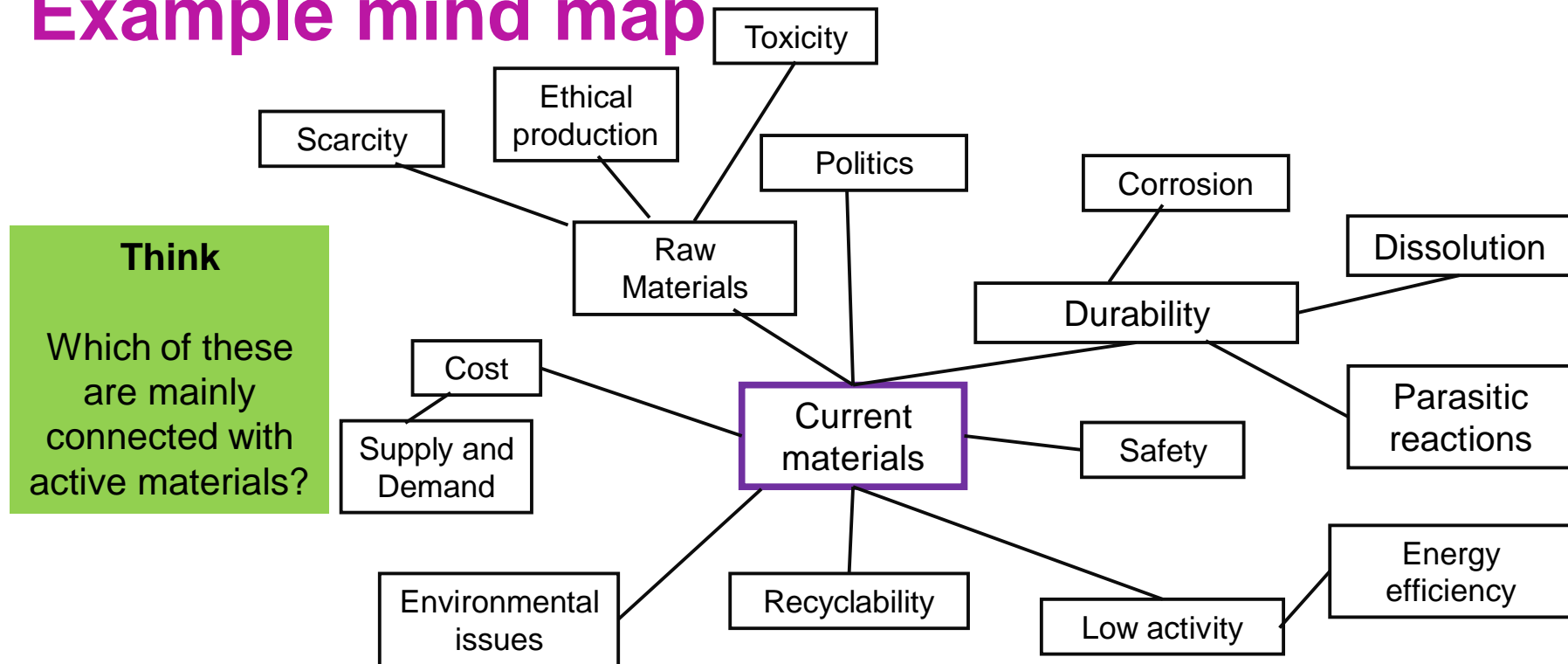
Challenge in current materials

Example mind map



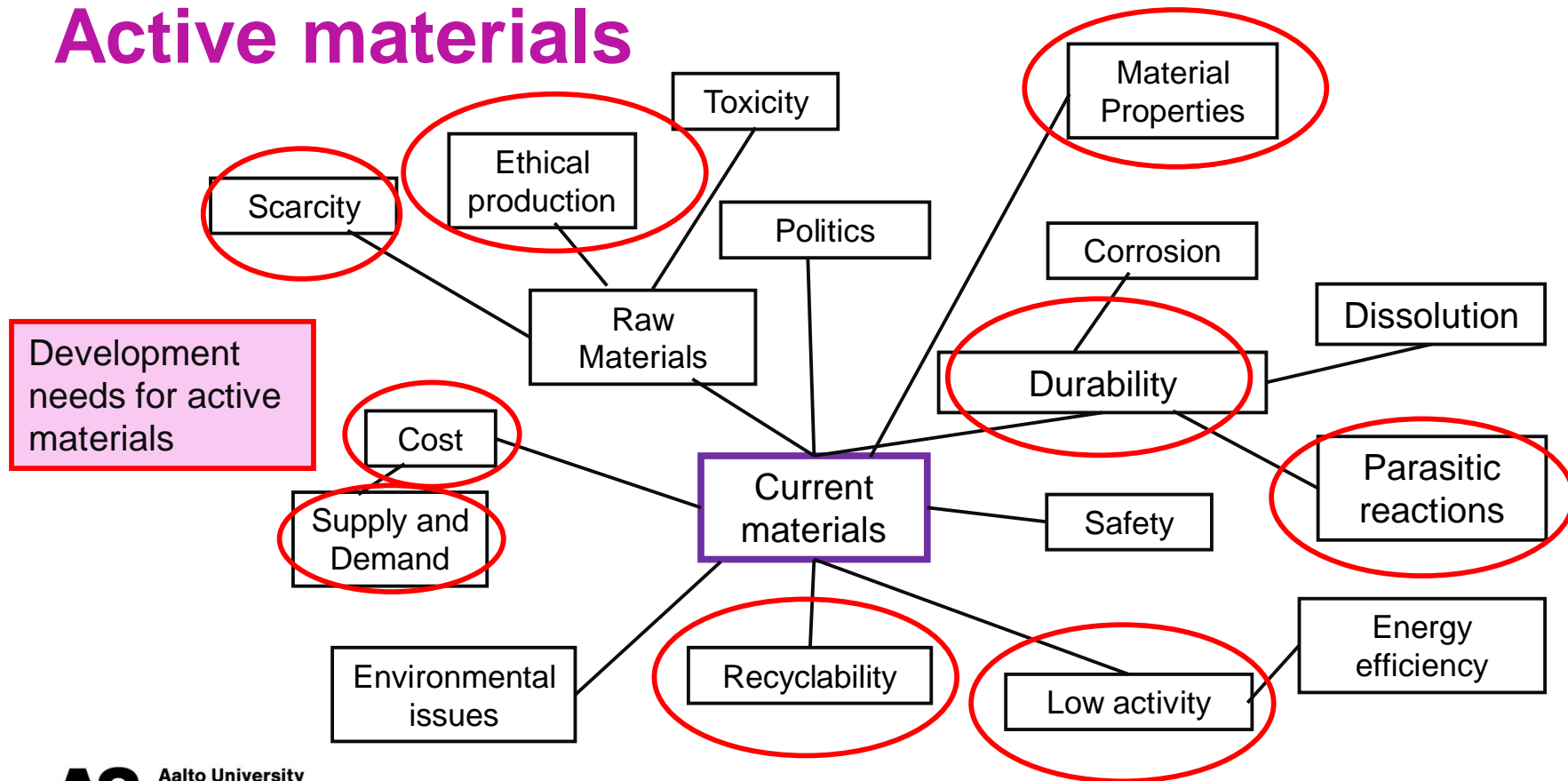
Challenge in current materials

Example mind map



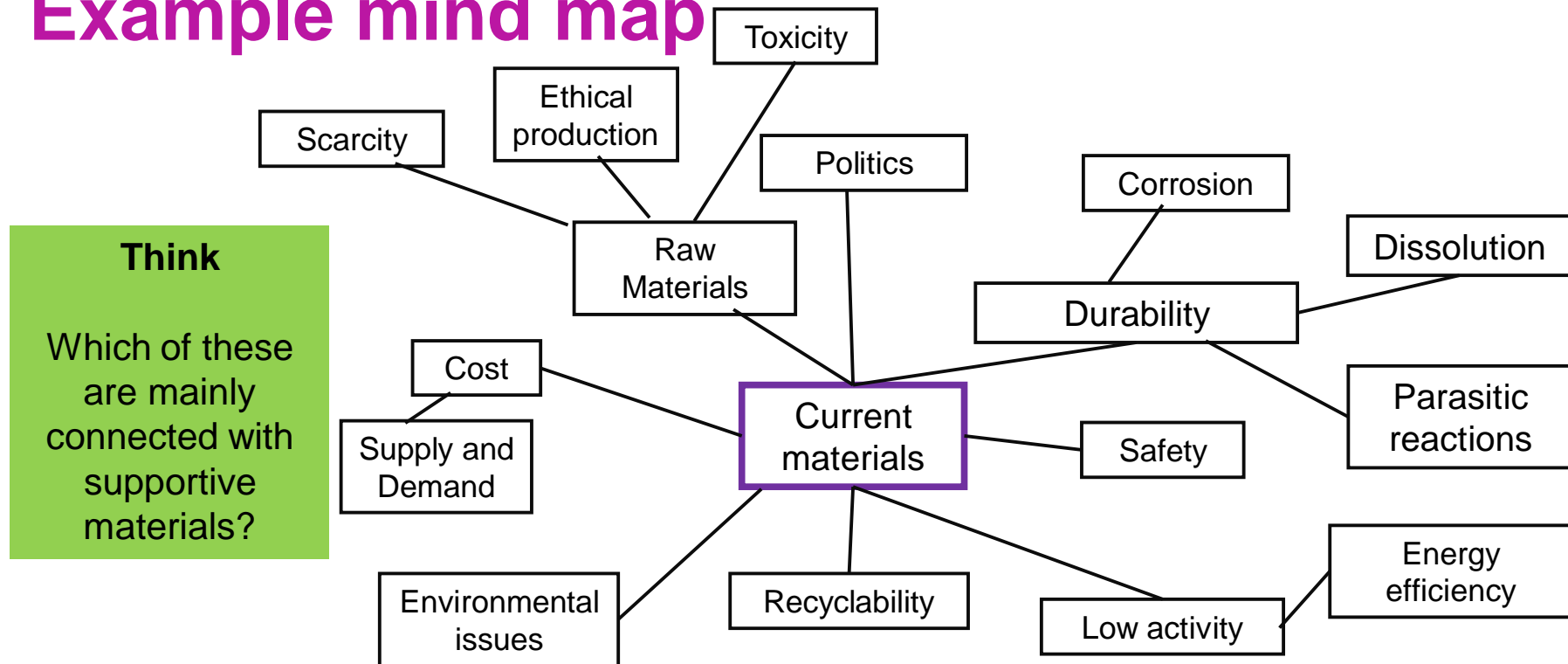
Challenge in current materials

Active materials



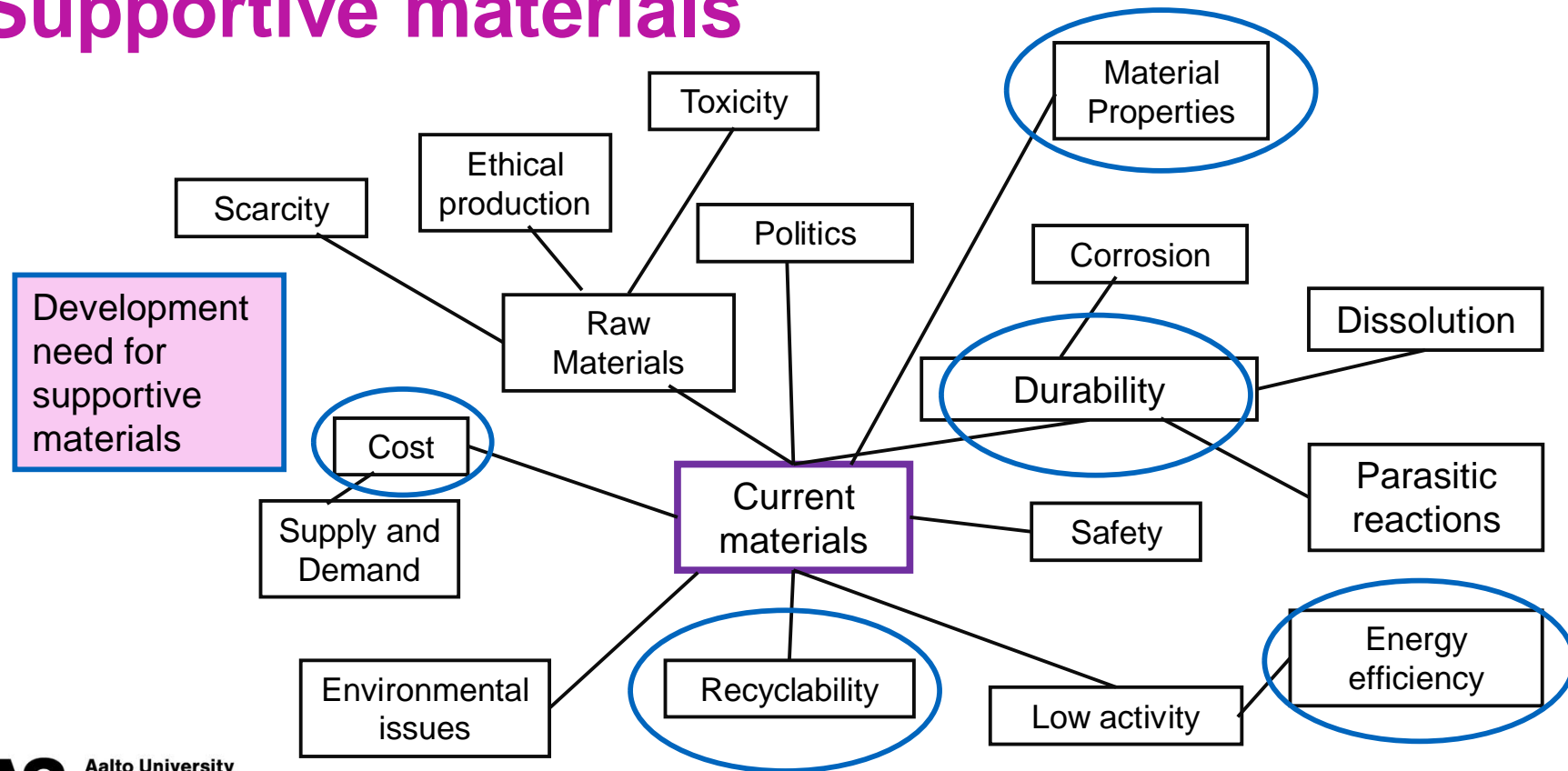
Challenge in current materials

Example mind map



Challenge in current materials

Supportive materials



New Material Solutions (NMS)

New Material Solutions (NMS)

New Material
Solution

is not always

A New Material

Often application of known materials or their
combinations to create

New Features

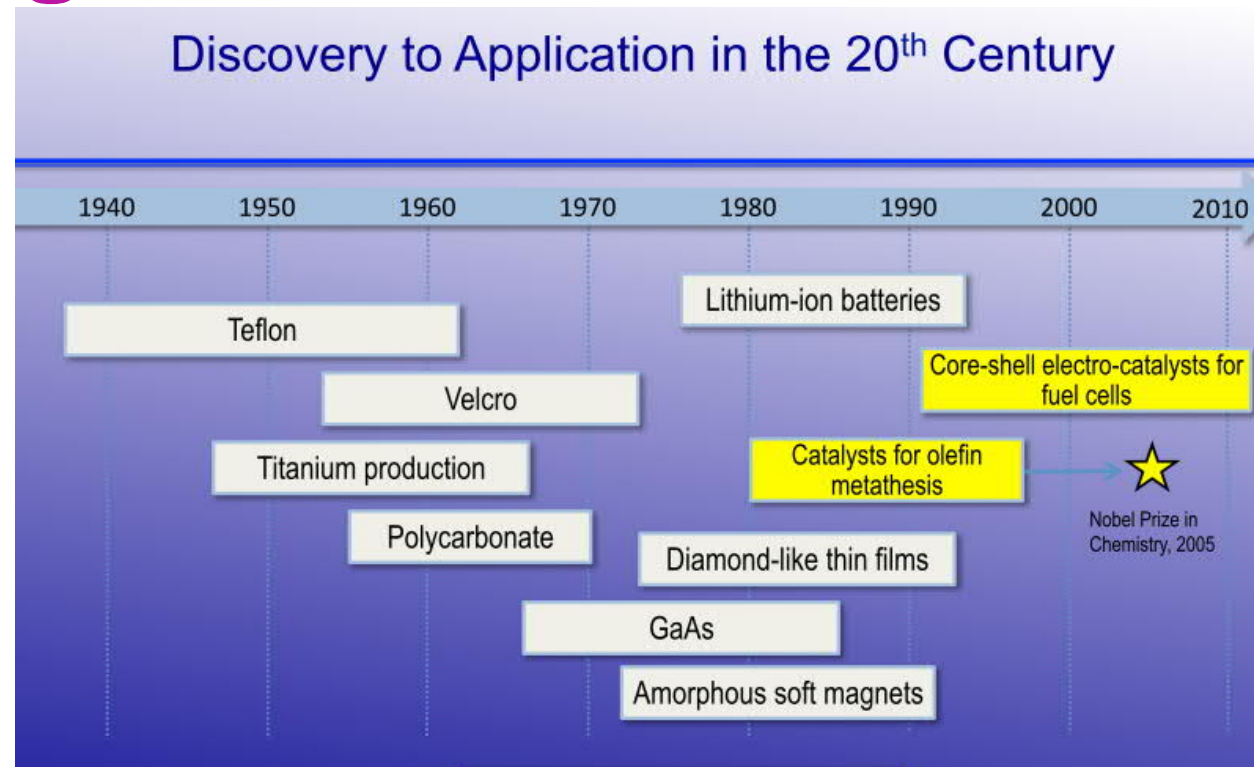
New Material Solutions (NMS)

New Material
Solution

Preparing is

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

How new material solutions are coming to market?

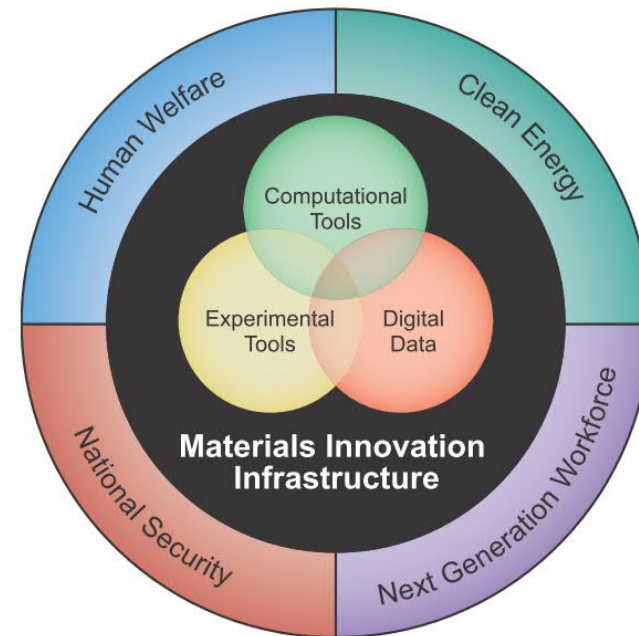
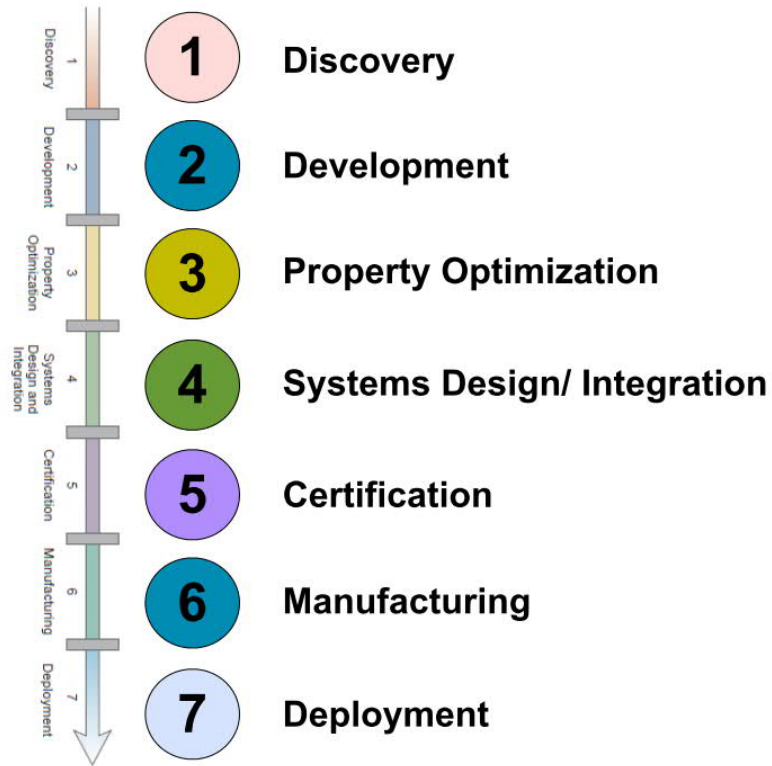


Steps to market

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What are the steps required for material development to come to the market.

Steps to market - example

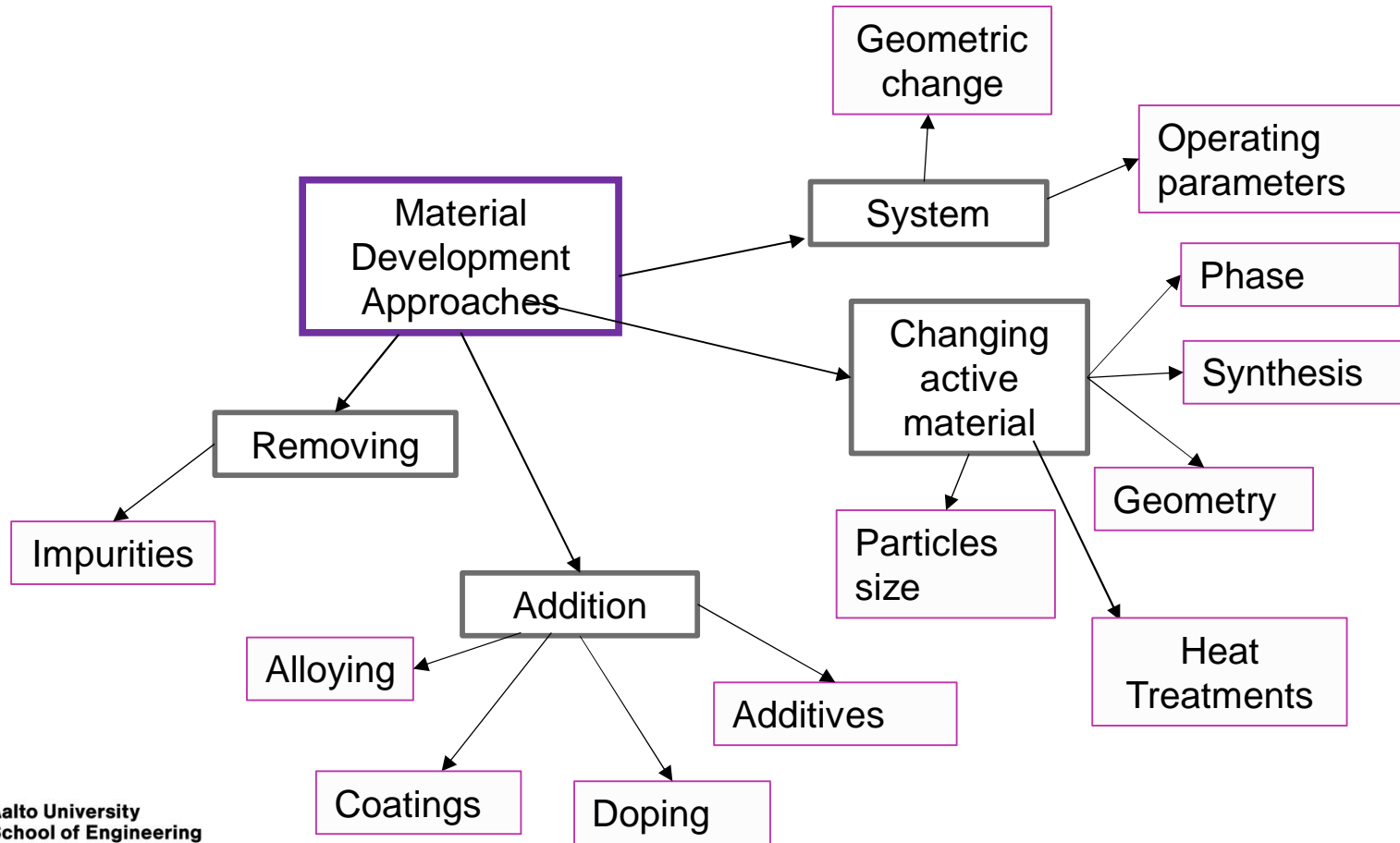


Developing materials

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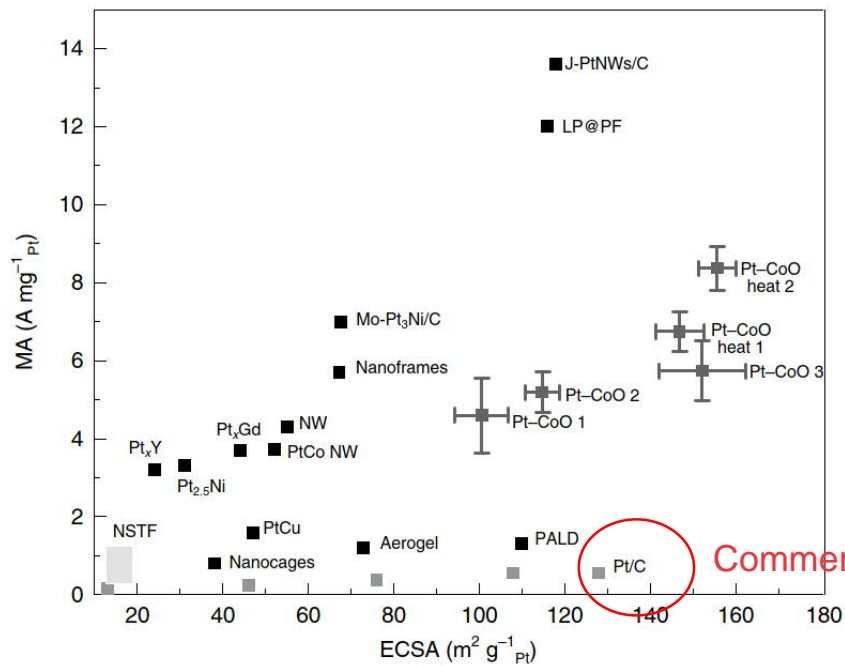
How can we create new features on materials? What can we do?
(Mind map or a list)

Developing materials



Performance

High impact -> focus on the performance



Active material

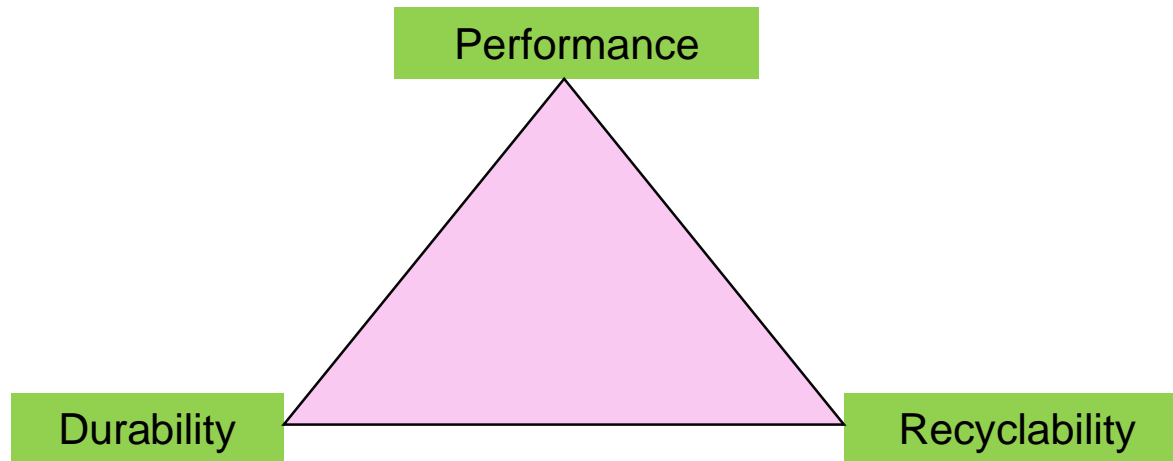
What is the activity of the catalyst?

- As it is (activity for the reaction)
- Activity in an application

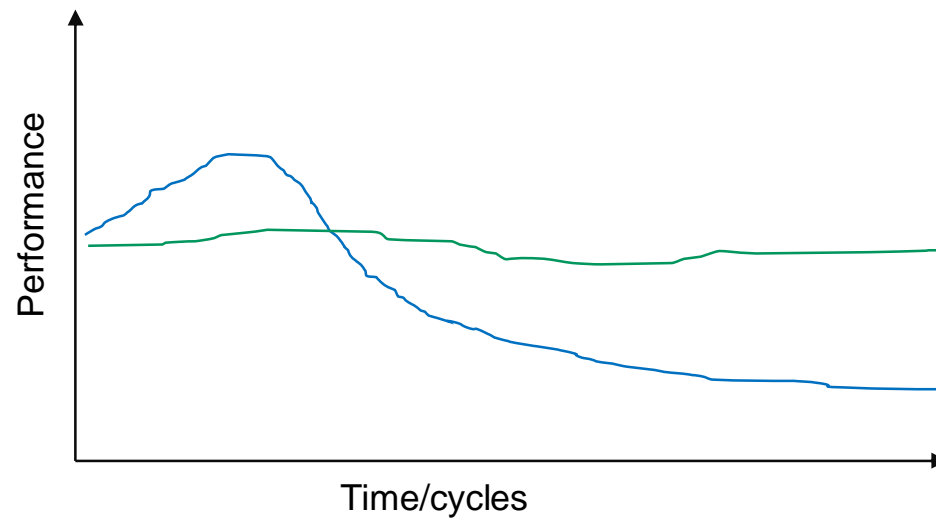
Short term activity (for 10 of cycles...)

-> is it useful?

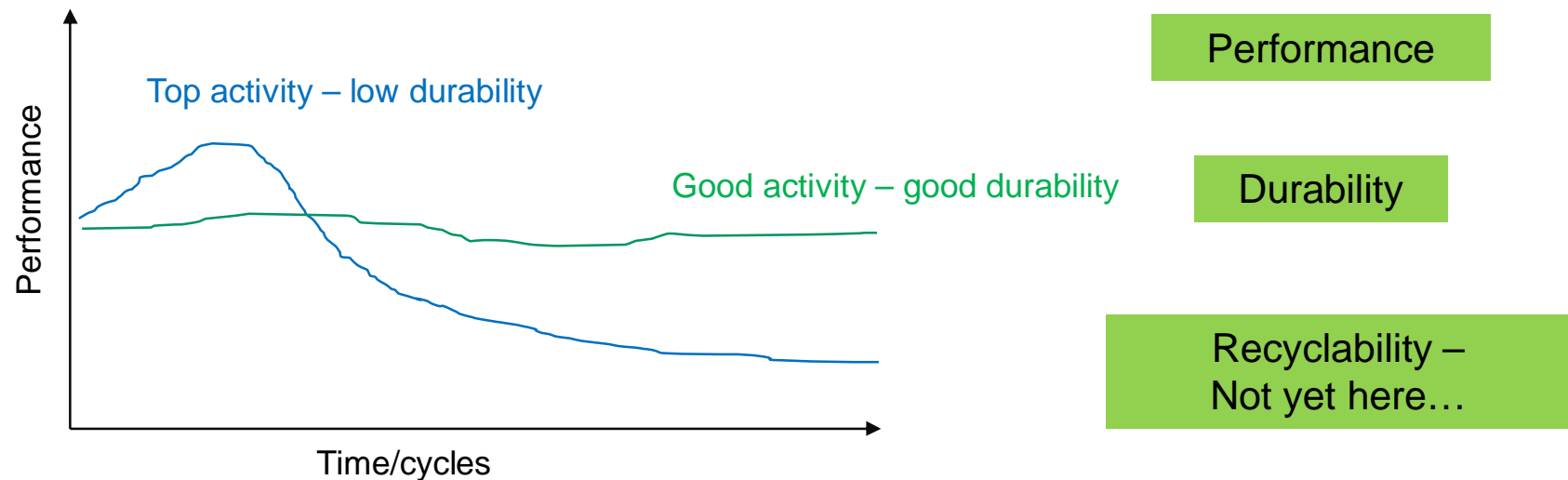
Is performance the most important?



What is valued in active material performance?



What is valued in active material performance?



High impact research aims for top activity (research funding) – be critical

Take a home message

Preparing New Material Solutions is **time consuming** and **expensive**. When high performance of an application is aimed, it needs to be demonstrated in the actual system and compared to the state-of-art materials.

High activity -> High efficiency ->
More sustainable application