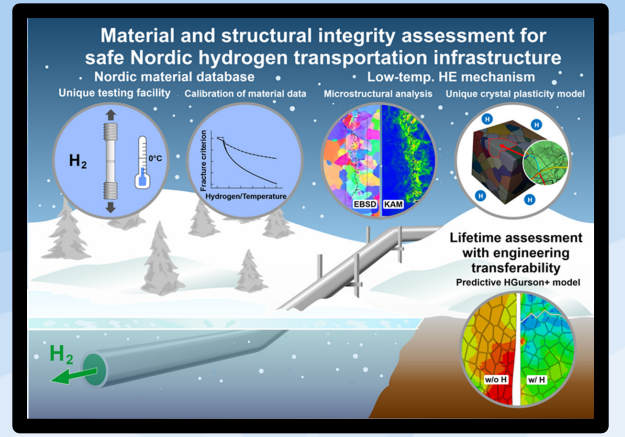


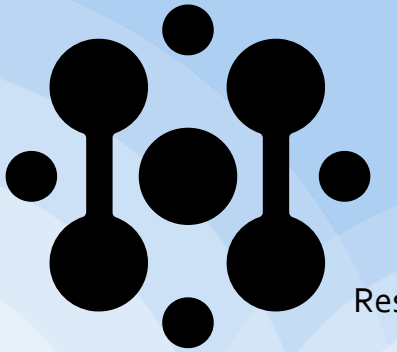
The MatHias project

- *Material and Structural Integrity Assessment for safe Nordic Hydrogen Transportation Infrastructure*

Nordic Energy Research

Vigdis Olden
The Nordic Hydrogen Valleys Conference 2023, Reykjavik, 4-5.10.23

The consortium



Research Partners

- SINTEF, Norway (Project Lead)
- University of Uppsala, Sweden
- VTT, Finland
- University of Oulo, Finland
- NTNU, Norway

Industry partners

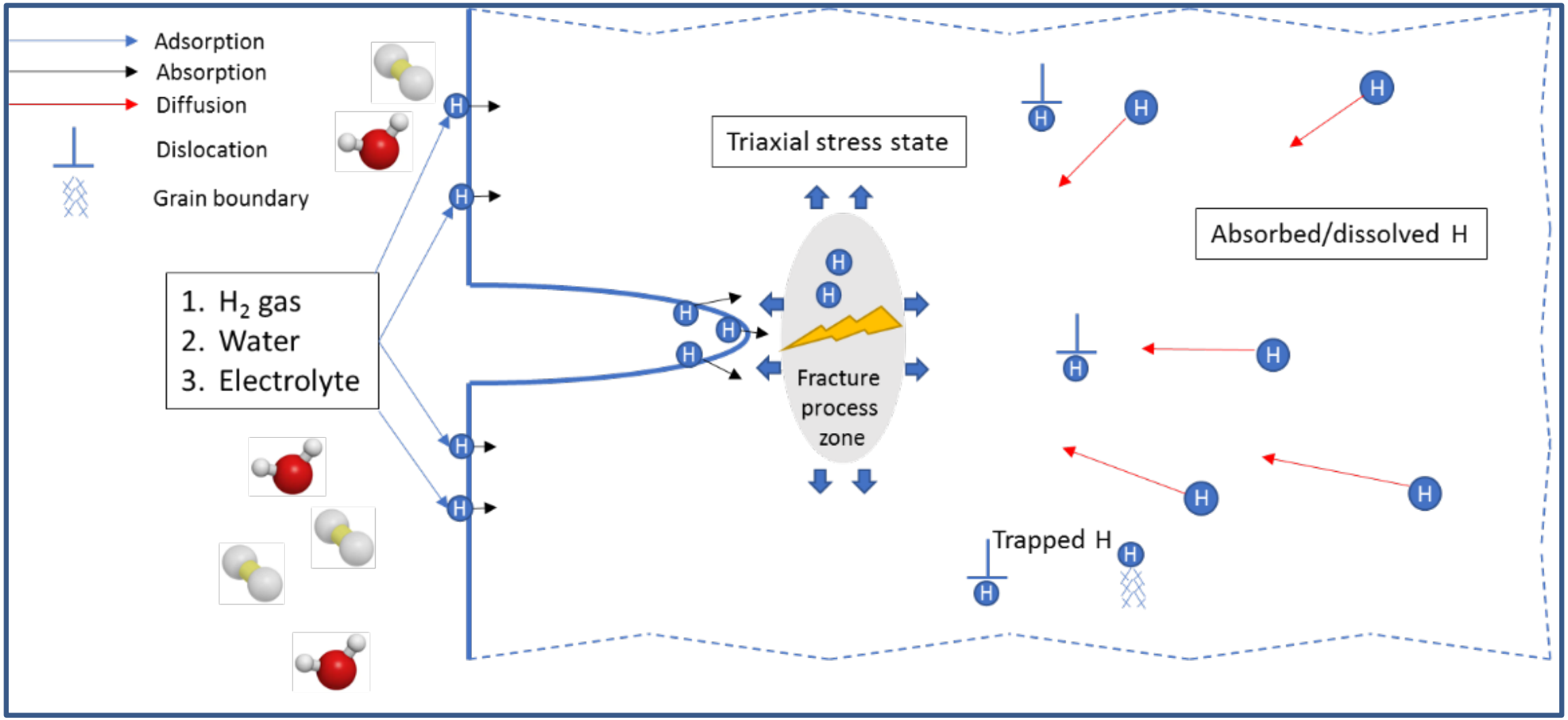
- SSAB, Finland
- Equinor, Norway

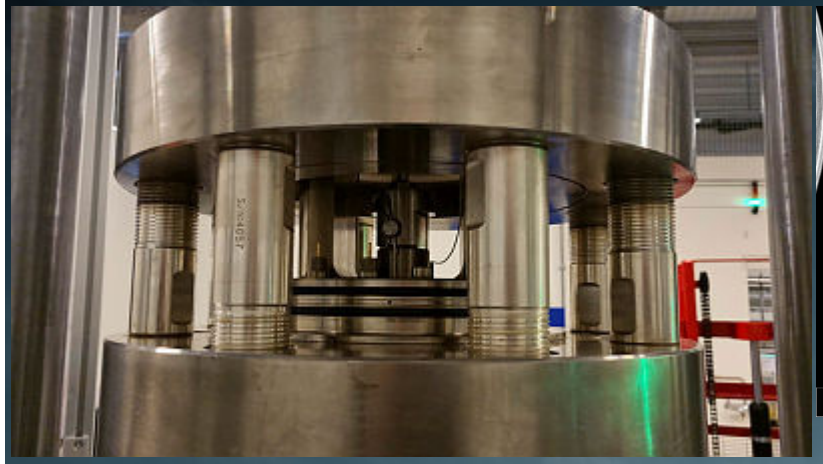
Observers

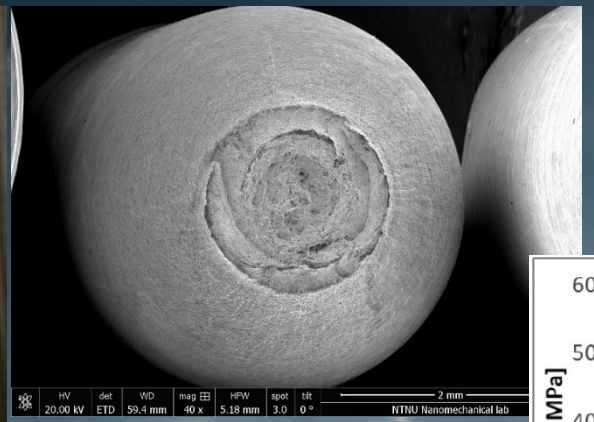
- Gasgrid Finland
- Nordion Energi, Sweden

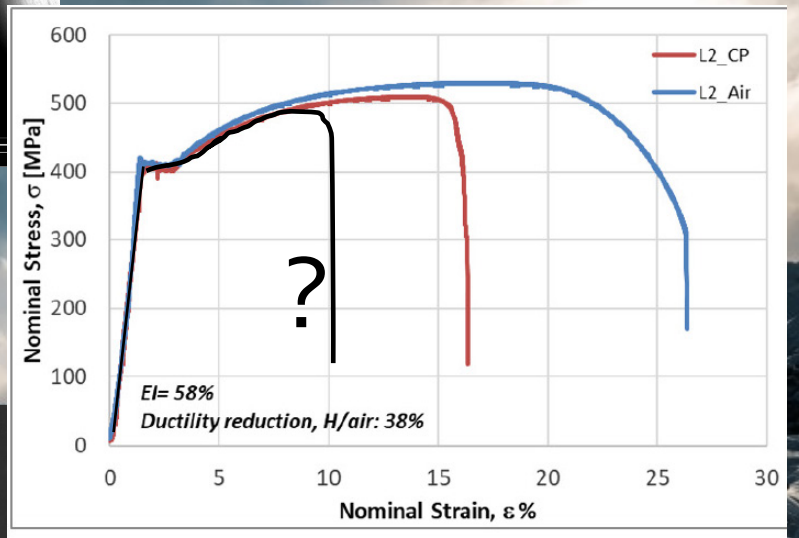
What does Material and Structural Integrity related to transport of H_2mean?

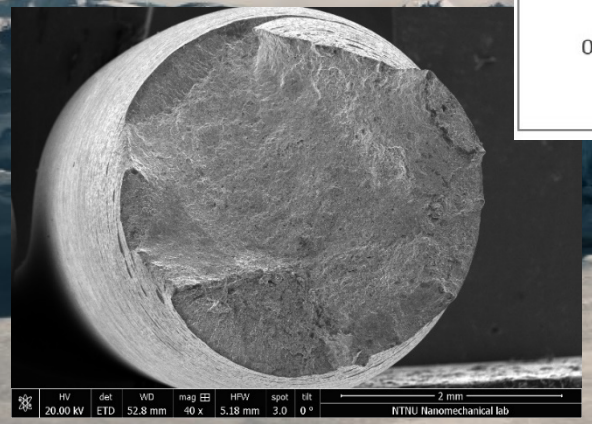
Nordic Energy Research


Adsorption
Absorption
Diffusion
Dislocation
Grain boundary
1. H_2 gas
2. Water
3. Electrolyte
Triaxial stress state
Fracture process zone
Absorbed/dissolved H
Trapped H



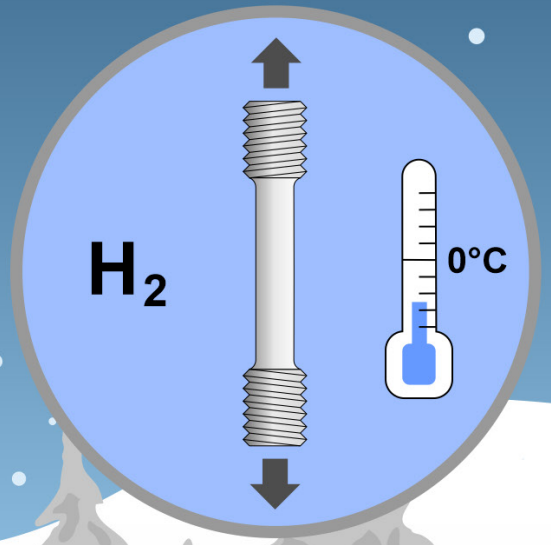

HV 20.00 kV
det ETD
WD 59.4 mm
mag 40 x
HFW 5.18 mm
spot 3.0
tilt 0 °
2 mm
NTNU Nanomechanical lab


600
500
400
300
200
100
0
0
5
10
15
20
25
30
Nominal Stress, σ [MPa]
Nominal Strain, ε %
L2_CP
L2_Air
?
EI= 58%
Ductility reduction, H/air: 38%

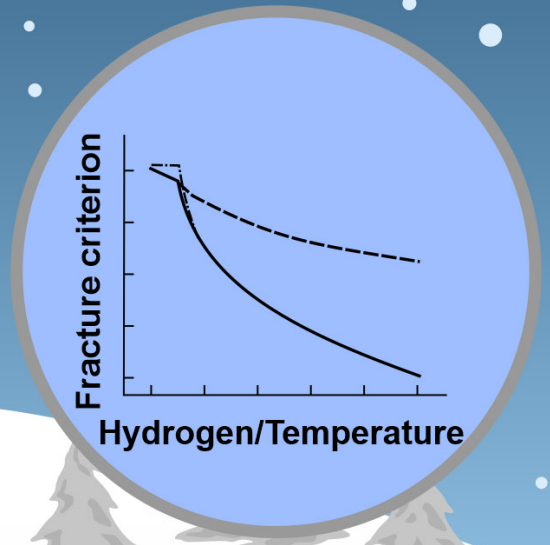

HV 20.00 kV
det ETD
WD 52.8 mm
mag 40 x
HFW 5.18 mm
spot 3.0
tilt 0 °
2 mm
NTNU Nanomechanical lab

Nordic material database

Unique testing facility

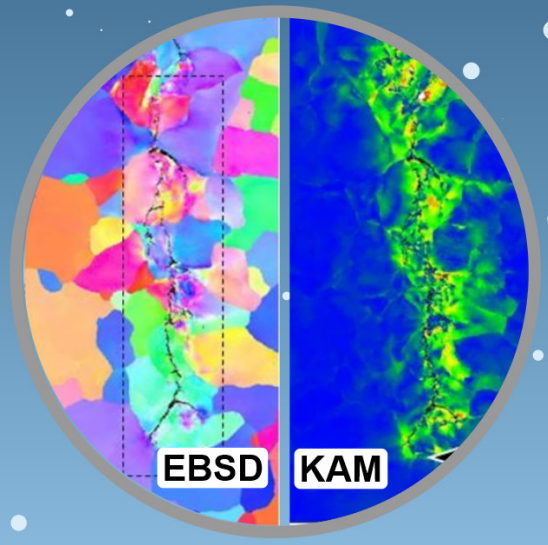


Calibration of material data

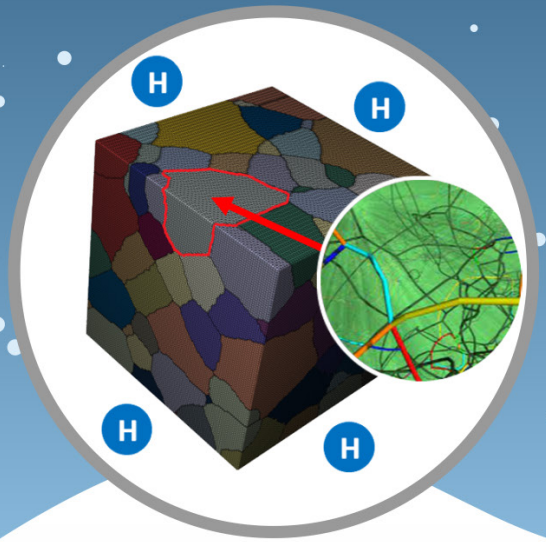


Low-temp. HE mechanism

Microstructural analysis

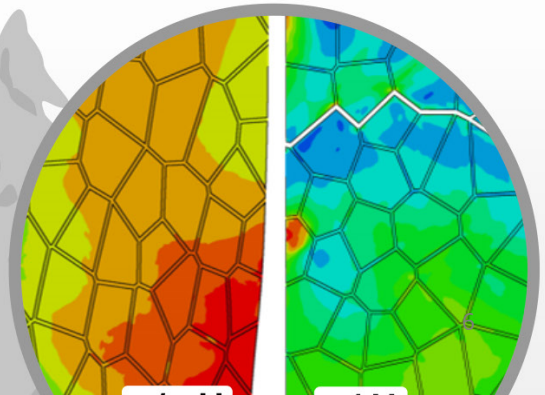


Unique crystal plasticity model



Structural integrity assessment with engineering transferability

Predictive Hgurson+ model



Nordic Energy Research

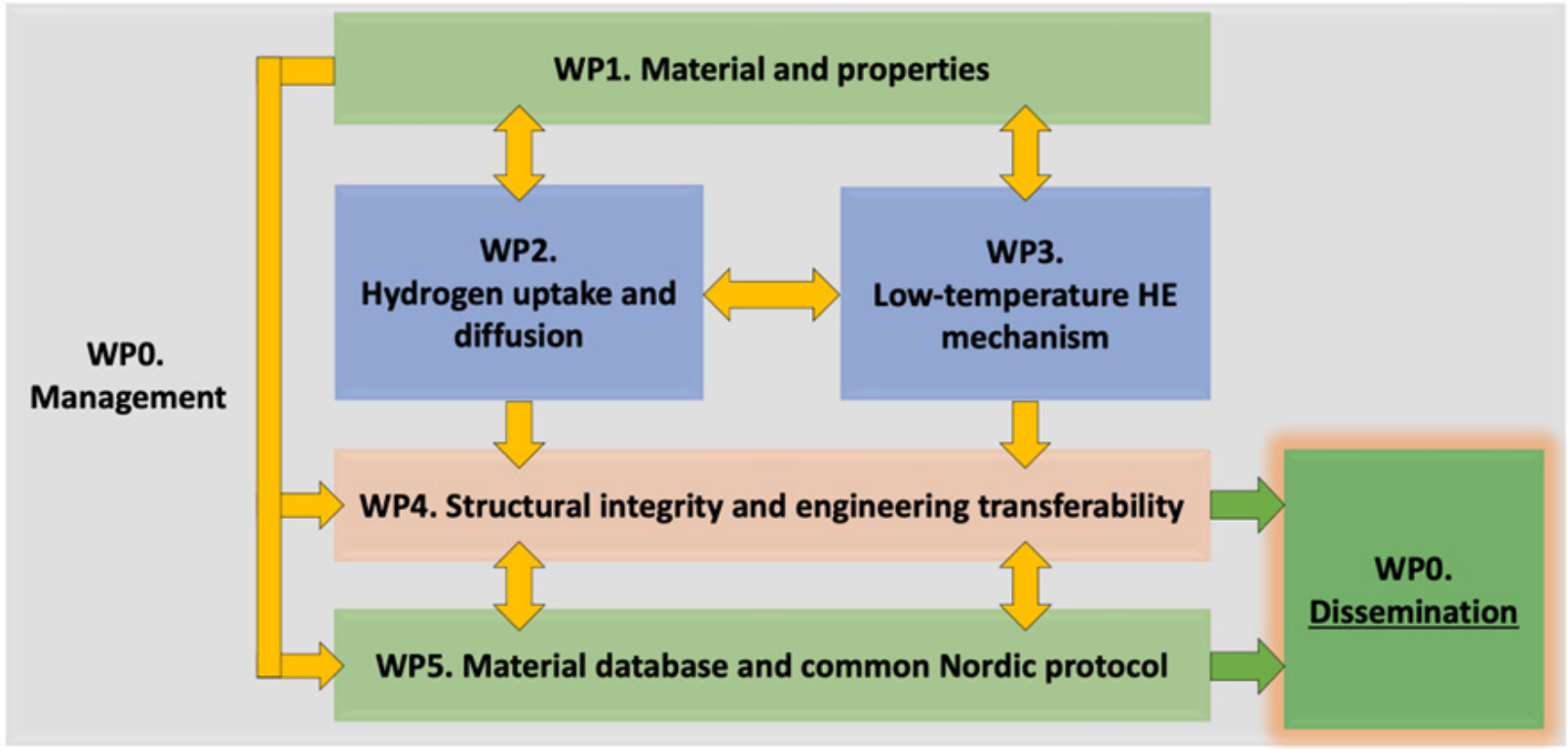
Nordic Hydrogen Valleys as Energy Hubs

MatHias

Objectives

- **Maintaining safe operation of hydrogen pipelines in the Nordic countries**
  - Providing tailored guidance on material selection for new pipelines.
  - Forming a knowledge base for future low temperature and hydrogen resistant steel development.
  - Developing a lifetime prediction tool for existing hydrogen pipelines.

Structure of MatHias

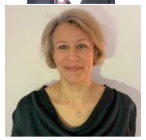


WP1: Uni. of Oulo (Sakari)

WP2: SINTEF (Bård)

WP3: Uppsala Uni. (Haiyang)

WP4: NTNU (Zhiliang)



WP5: VTT (Elina)

WP0: SINTEF (Vigdis)

For discussion

- Material and structural integrity are relevant in all situations where hydrogen is in direct contact with structural materials, and where safety and lifetime of components are important.
- Are there other parts of the H2 value chain where the structural integrity will be of relevanse?

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Thanks!