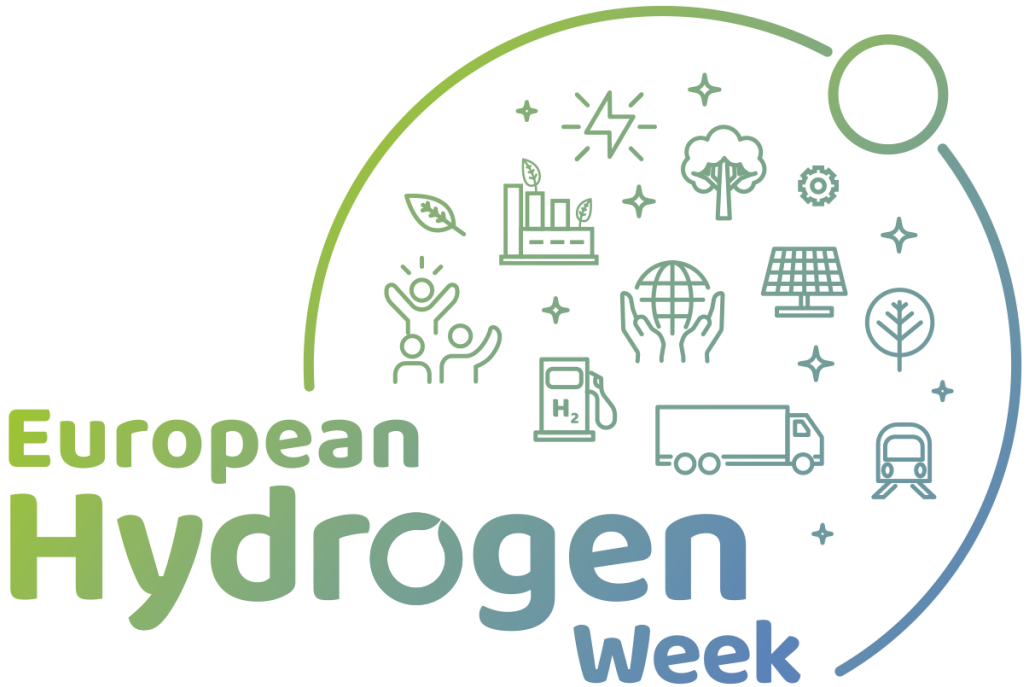

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European Commission

LOWCOST-IC

Low Cost Interconnects with highly improved Contact Strength for SOC Applications

General info

- H2020, FCH2
- Start: 1st of January 2019
- End: 30th of June 2022 (assuming extension)
- Budget: 2.34 mil. €
- Number of partners: 10 (7 companies, 3 research institutions)

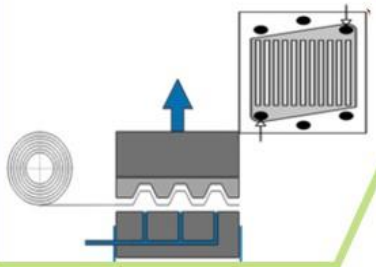
Objectives

- Decreasing cost of steel interconnects for SOFC and SOEC:
  - New cheaper steels > 80 % cost reduction, same performance
    - Development of coatings
  - Test mass manufacturing processes
    - Join roll-to-roll processes
- Increase lifetime by:
  - Increasing strength of cell and interconnect interface by >200 %
    - Development of contact layer
  - Minimize stresses in interface between cell and interconnect
    - Optimize flow distribution

European Hydrogen Week

LOWCOST-IC

The consortium

Raw materials	Coating	Design + Shaping	Contact layer application	Implementation + Testing
aperam	SANDVIK	borit®	TECNO ITALIA®	sunfire / SOLID POWER
				

Testing and evaluation

CHALMERS	JÜLICH FORSCHUNGSZENTRUM	DTU Technical University of Denmark	AVL
Coating research	Interconnect design	Contact layer	Cost analysis

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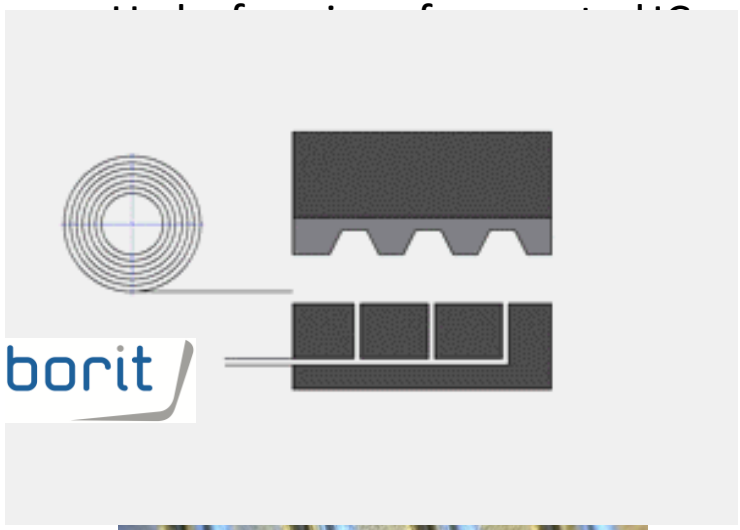
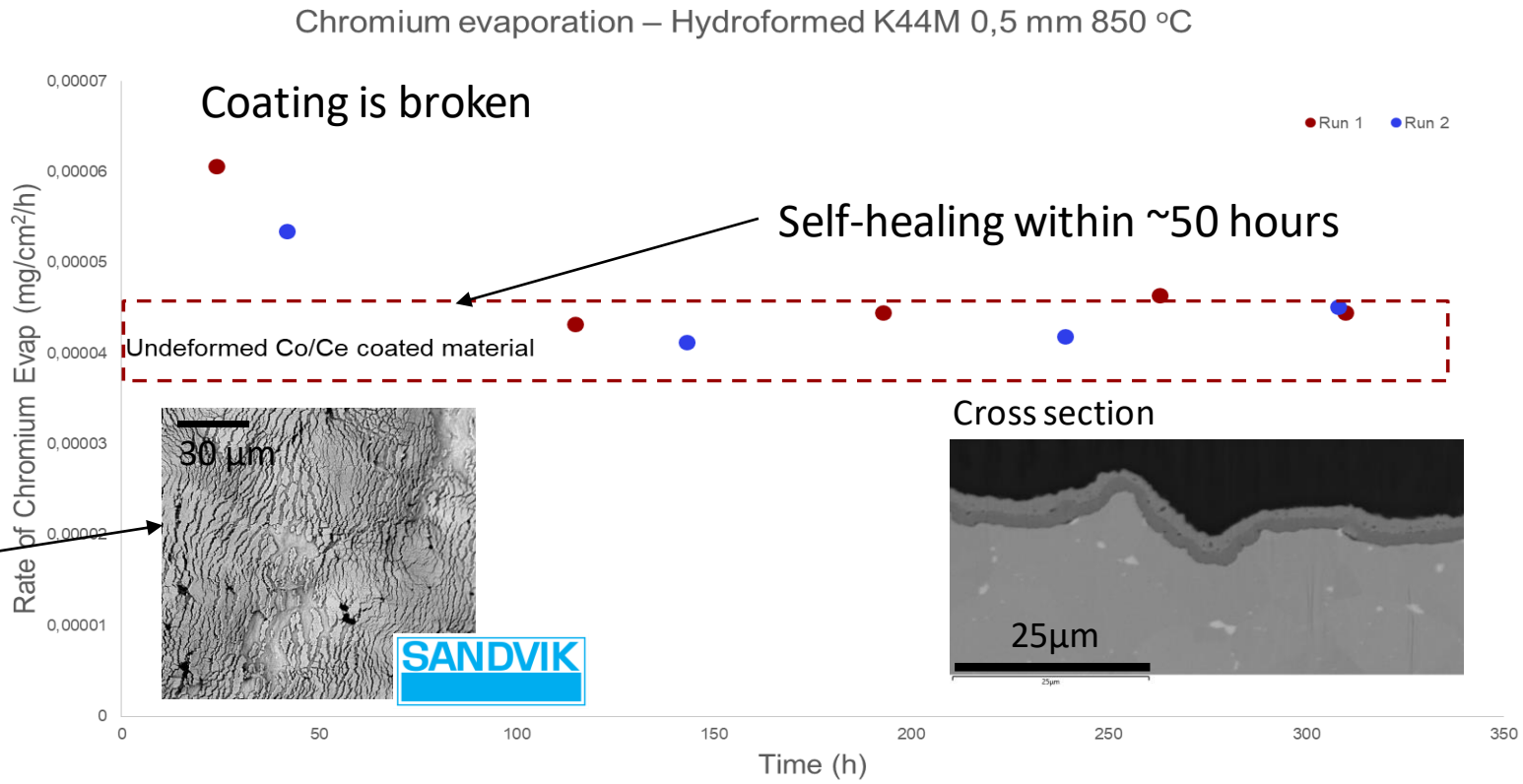
FCH

European Commission

Highlight 1:
Roll-to-roll process test





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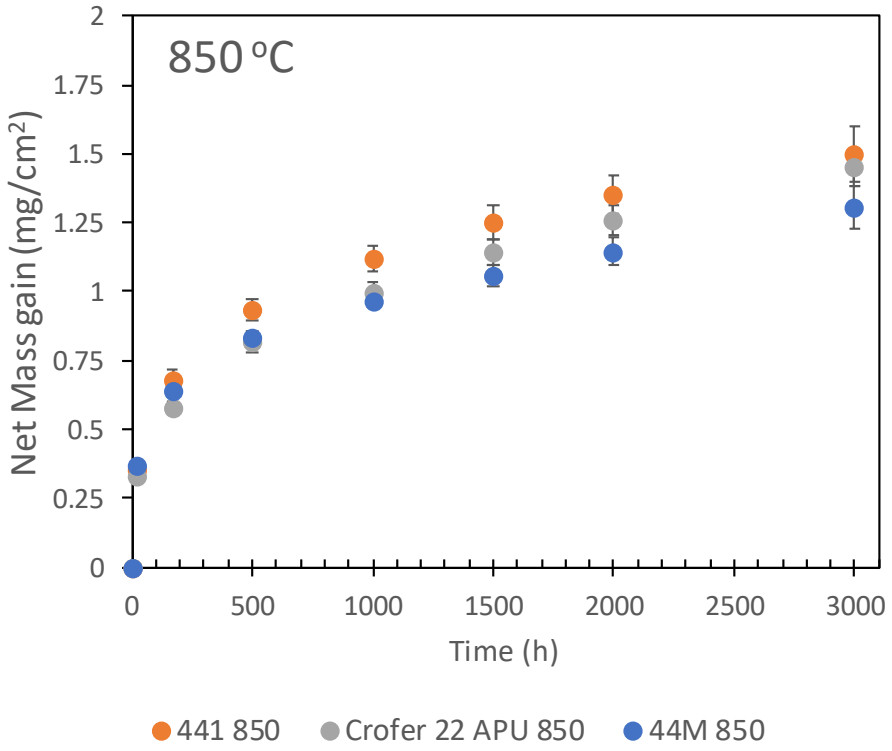
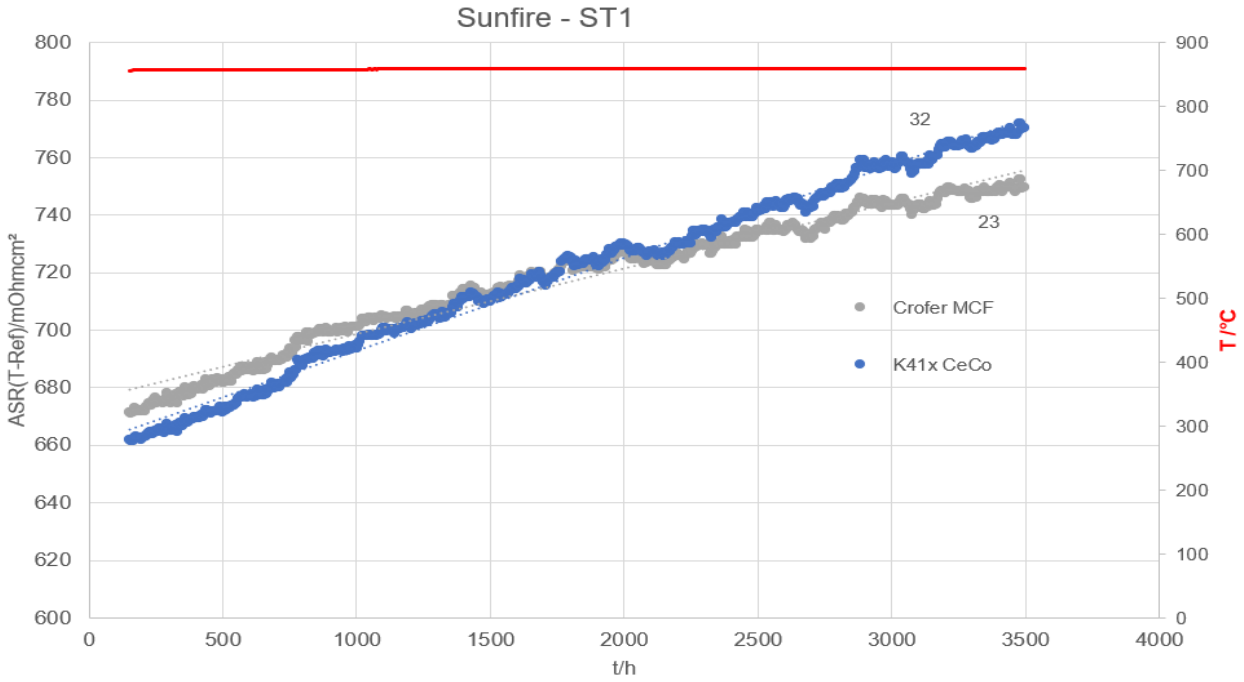
Highlight 2: Performance of low cost coated steel

Corrosion mass gain similar in lab



But degradation faster in stack test



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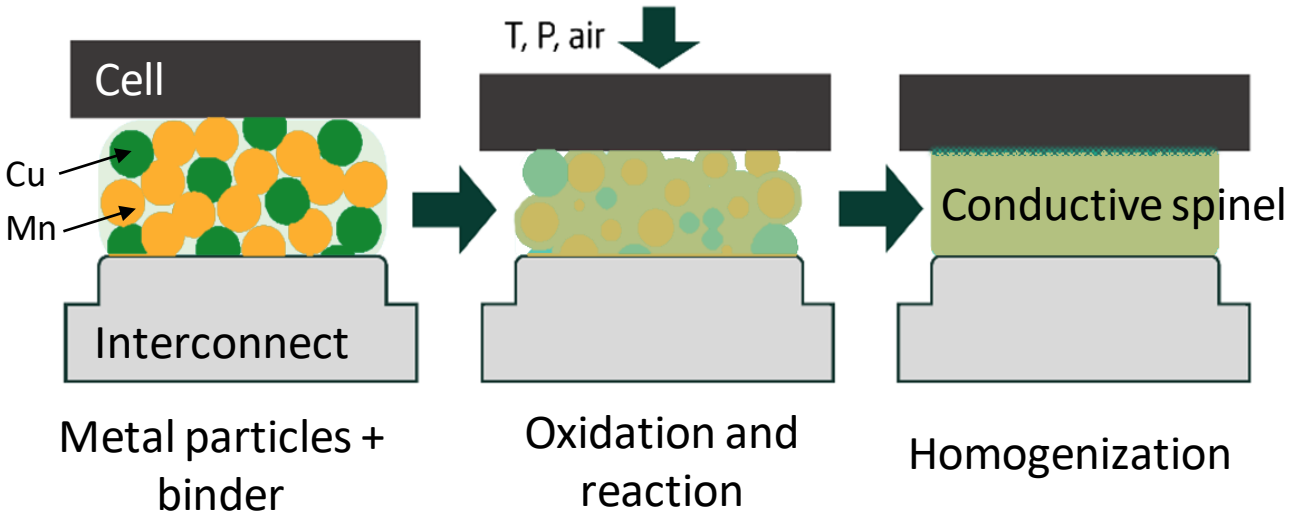
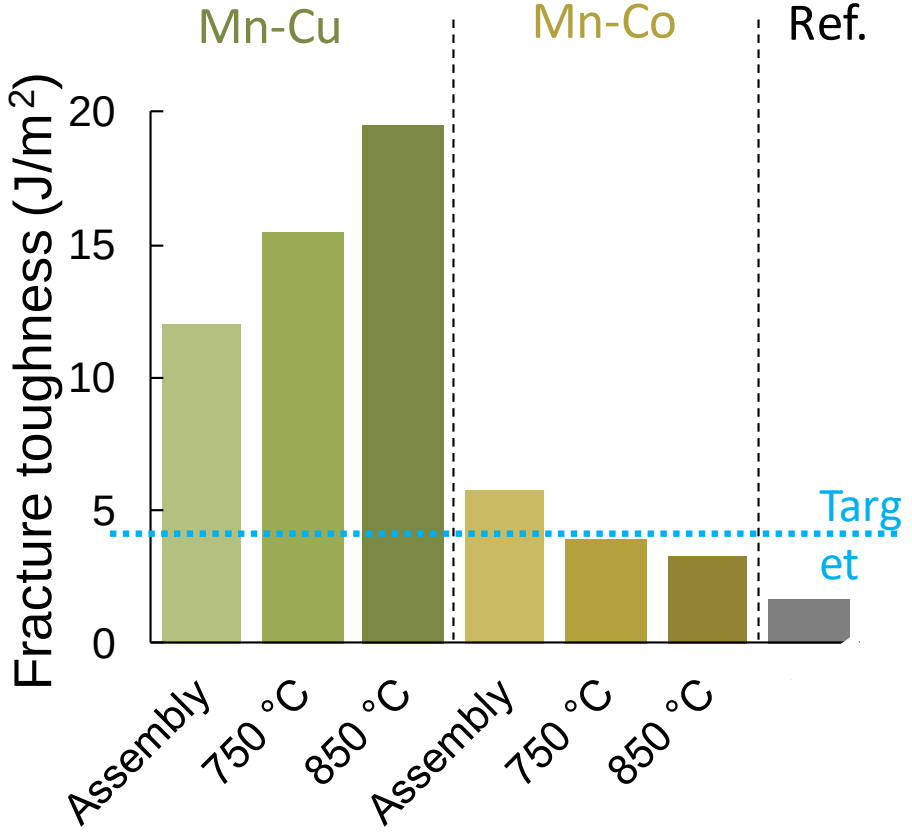
Highlight 3: High adhesion contact layers

Reactive bonding principle





$9 \cdot Mn\,(s) + 6 \cdot Cu\,(s) + 10 \cdot O_2\,(g) \rightarrow 5 \cdot Mn_{1.8}Cu_{1.2}O_4\,(s)$

$Mn\,(s) + 2 \cdot Co\,(s) + 2 \cdot O_2\,(g) \rightarrow MnCo_2O_4\,(s)$

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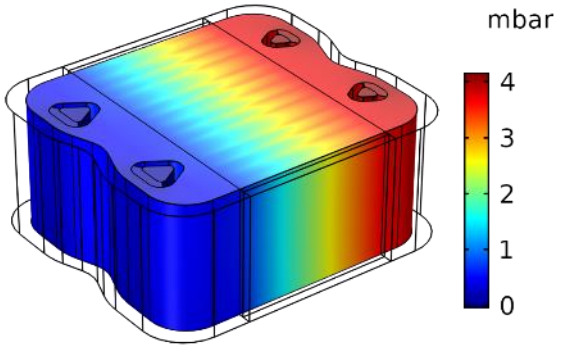
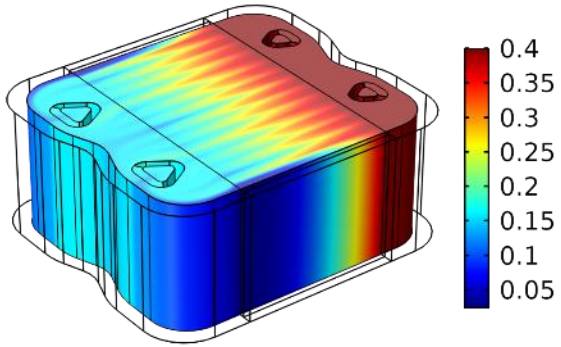
Highlight 4:
Fast multiphysics multiscale model

- Build in Comsol Multiphysics
  - Using homogenization
- Runs in ~30 min
  - 100 cell stack
  - **>100 times faster** than SoA
- **All physics included**
  - mass, heat, current, flows, etc.
  - also solid mechanics, turbulent flow in manif.

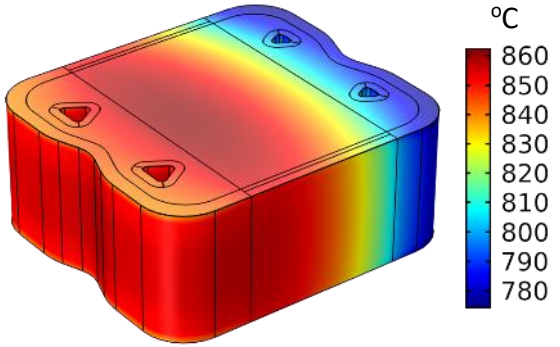
Fuel pressure variation



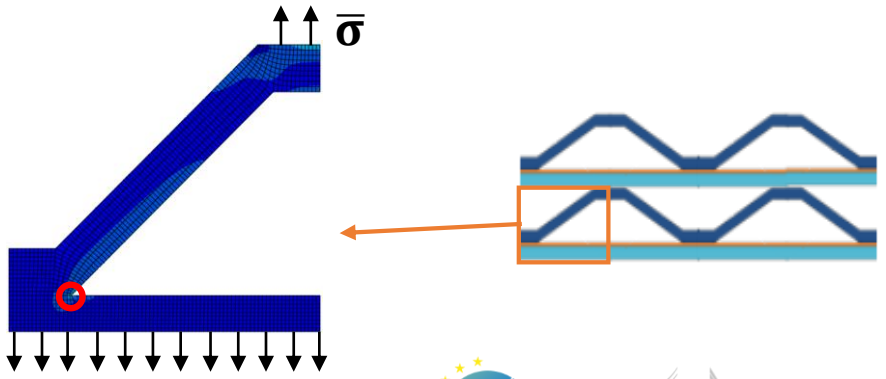
Hydrogen molar fraction



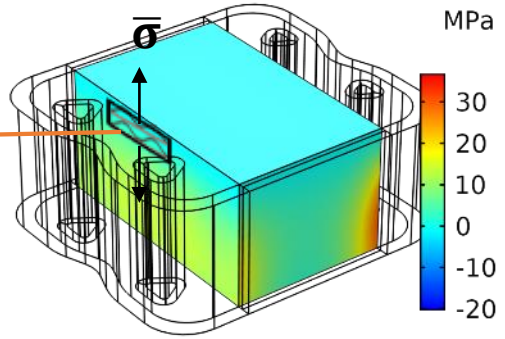
Temperature distribution



Submodel for mechanical stresses



Mechanical stresses



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Conclusions

- Feasibility of roll-to-roll process demonstrated feasible (coating, shaping)
  - Due to self healing of coating
- Low cost steels showed to perform similar as high cost steels (in lab)
  - Further research needed for the stack
- High robustness contact layers obtained
  - Using reactive bonding
- Fast multiscale multiphysics modelled developed
  - Will be used for flow geometry optimization

Acknowledgements

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (JU) under grant agreement No 826323. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Denmark, France, Austria, Belgium, Sweden, Germany, Italy"

Thank you for the attention