

WEBINAR

Synergies Spotlight

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Speaker Intro – Anna T.S. Freiberg

- Helmholtz Association
 - Forschungszentrum Juelich GmbH
 - Helmholtz Institute Erlangen-Nuernberg (IET-2)
 - Electrocatalytic Interface Engineering Department
 - Team leader: Interface Engineering for Water Electrolysis
- Team founded in 2020
- 7 PhD students, 1 Post-Doc
- Efficient green H₂ production by Water Electrolysis
 - Liquid alkaline water electrolysis (AEL)
 - Anion exchange membrane water electrolysis (AEMWE)
 - Proton exchange membrane water electrolysis (PEMWE)
 - ... (< 200°C)



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Shared Ambition

- ELECTROLIFE: Enhance knowledge on comprehensive electrolyser degradation technologies towards industrialization
- DELYCIOUS: Diagnostic tools for electrolysers: Cost-efficient, Innovative, Open, Universal and Safe



Accelerate the decarbonization of European industry by overcoming current limitations in electrolysis technologies.

Enabling cost efficient production of Green Hydrogen

***CAPEX // OPEX
Reliability & Durability***

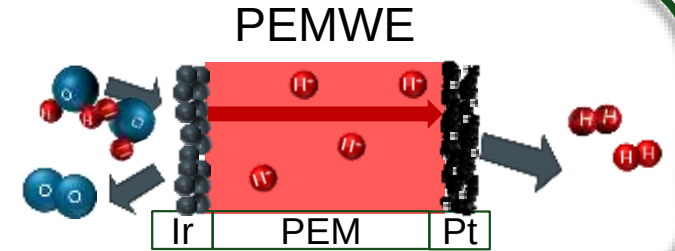
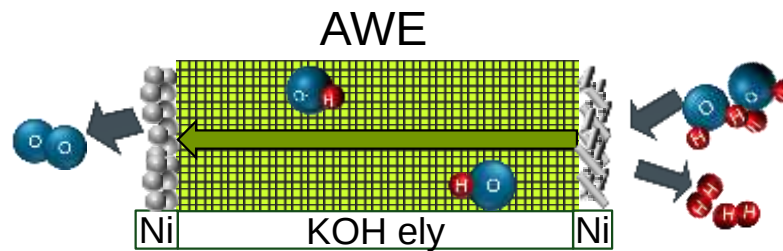
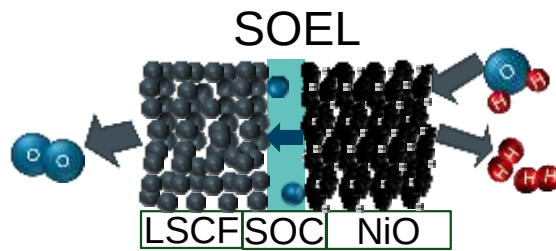
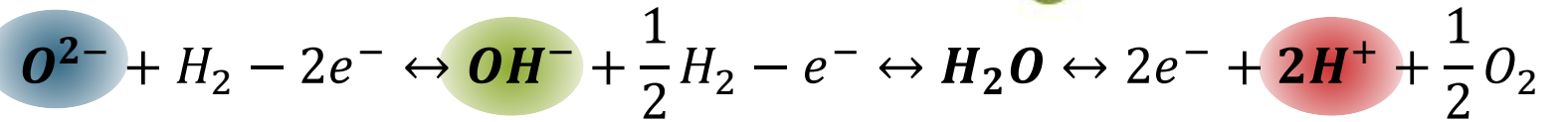
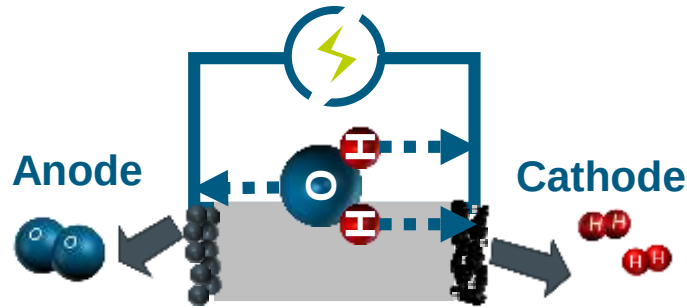
***LCOH
Flexibility***



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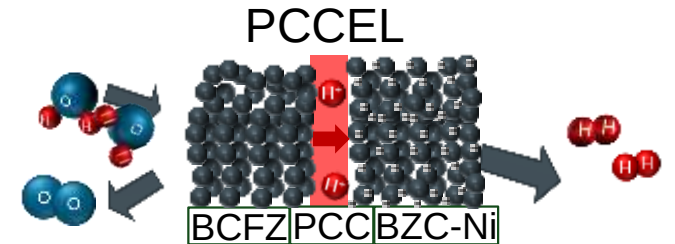
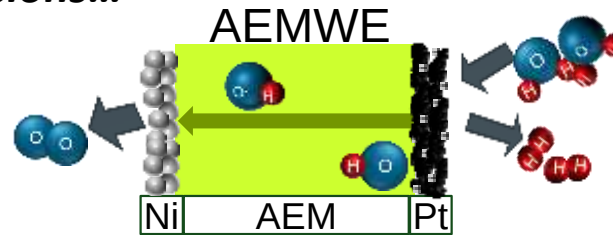
Overlapping Technologies



Different pH, T, materials, relative dimensions...

Similar classes of aging:

- Reversible voltage decay
- Oxidation state changes
- Crack formation
- ...



**Materials shown here are mere examples*



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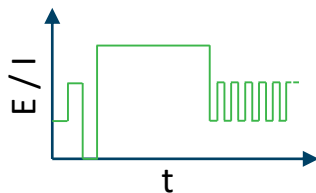


Complementary Approach

- ELECTROLIFE: Enhance knowledge on comprehensive electrolyser degradation technologies towards industrialization
- DELYCIOUS: Diagnostic tools for electrolyser: Cost-efficient, Innovative, Open, Universal and Safe



Experimental investigation of component degradation mechanisms in 5 different technologies



"Online" diagnostics

- CVs
- EIS
- HTO

- Steady-state voltage decay
- Component and technology specific AST development
- Industry and lab materials

Ex-situ analysis of stressor impact on component changes



Comp.	Char A	Char B	Char C
1	x	✓	✓
2	✓	x	x
3	x	✓	x

Modelling of degradation mechanism impact on durability



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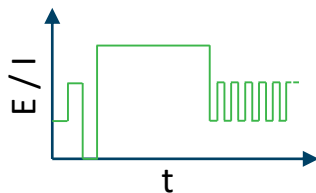
Complementary Approach

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Experimental investigation of component degradation mechanisms in 5 different technologies

Experimental investigation of short stack degradation and lifetime in 5 different technologies



"Online" diagnostics

- CVs
- EIS
- HTO



- Steady-state voltage decay
- Component and technology specific AST development
- Industry and lab materials

Prediction diagnostics of lifetime

Validating degradation models

Modelling of degradation mechanism impact on durability



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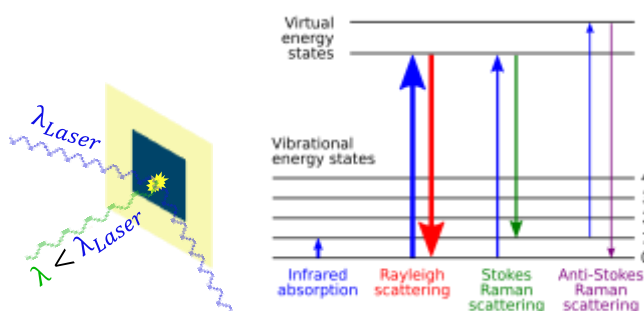


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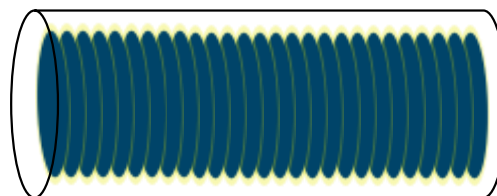


Experimental investigation of performance degradation in 3 different technologies



- Harmonized profile for lab scale technology testing
- Specialized hardware integration to measure degradation trends
 - EIS
 - Raman spectroscopy

Large-scale tool demonstration on > 450 kW AEL



Resilience and scalability

Monitoring and Operation Optimization

EMS alongside open-access monitoring and diagnostic platform

Advanced monitoring tools

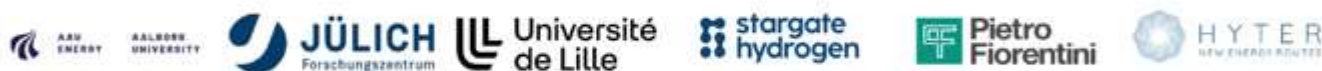
Hybrid algorithm development for degradation prediction



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Thank you!



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