# WEBINAR
# Synergies Spotlight

*Anna T.S. Freiberg*

*Helmholtz Institute Erlangen-Nuernberg*

Enhance durability of electrolyser technologies
ELECTROLIFE

Clean Hydrogen Partnership

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# Speaker Intro – Anna T.S. Freiberg

Enhance durability of electrolyser technologies
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HIERN
Helmholtz Institute Erlangen-Nürnberg

- 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 $H_2$ 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 electrolysers degradation technologies towards industrialization
- DELYCIOUS: Diagnostic tools for electrolysers: Cost-efficient, Innovative, Open, Universal and Safe

Enhance durability of electrolyser technologies
ELECTROLIFE

***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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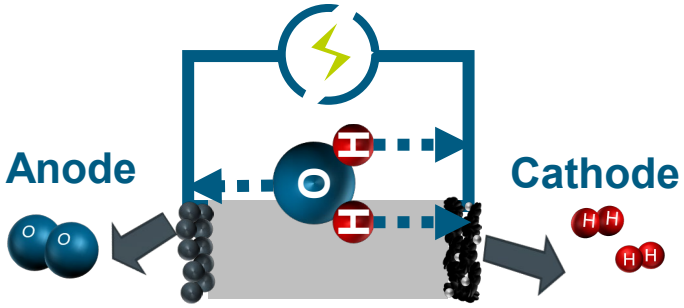
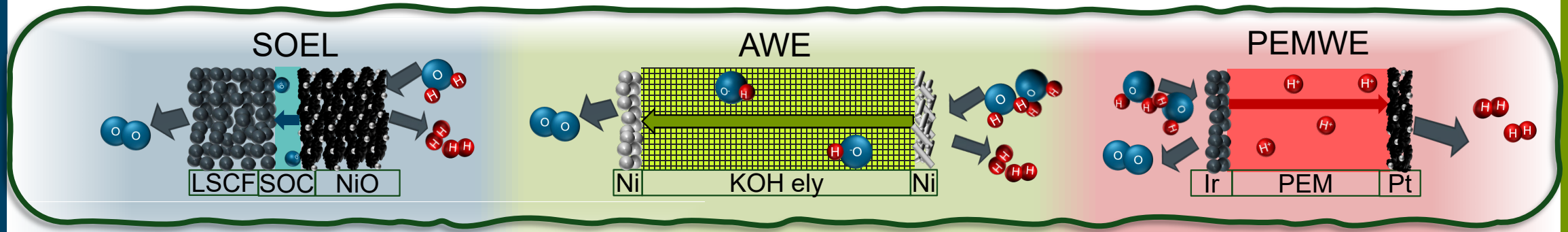
# Overlapping Technologies

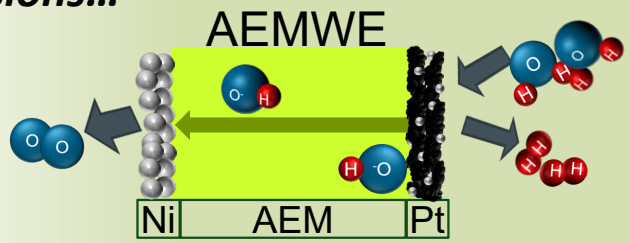


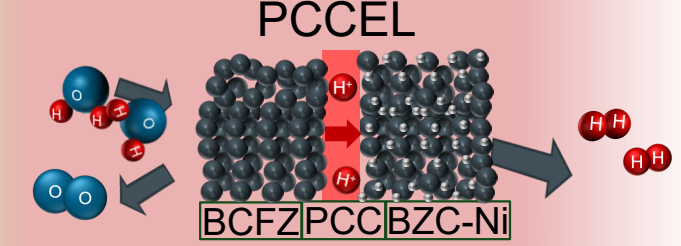

$$O^{2-} + H_2 - 2e^- \leftrightarrow OH^- + \frac{1}{2}H_2 - e^- \leftrightarrow H_2O \leftrightarrow 2e^- + 2H^+ + \frac{1}{2}O_2$$

Enhance durability of electrolyser technologies
ELECTROLIFE




***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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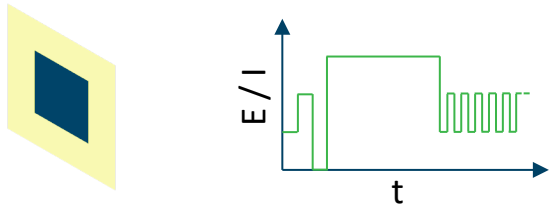
# Complementary Approach

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

Enhance durability of electrolyser technologies
ELECTROLIFE

***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 | × | ✓ | ✓ |
| 2 | ✓ | × | × |
| 3 | × | ✓ | × |

***Modelling of degradation mechanism impact on durability***

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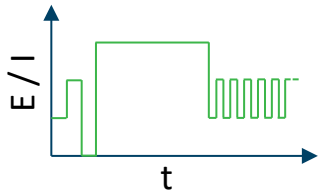
***Experimental investigation of component degradation mechanisms in 5 different technologies***




*"Online" diagnostics*
- *CVs*
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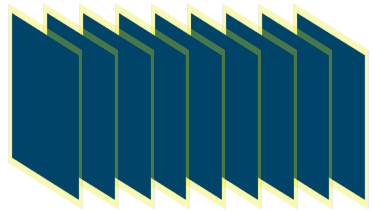
***Experimental investigation of short stack degradation and lifetime in 5 different technologies***



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

***Modelling of degradation mechanism impact on durability***

***Validating degradation models***

***Prediction diagnostics of lifetime***

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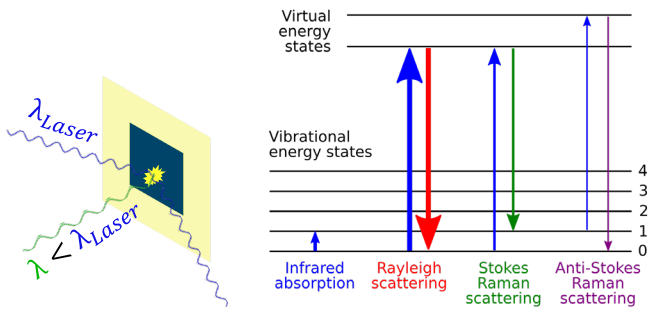
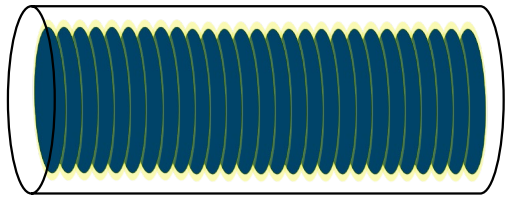
***Experimental investigation of performance degradation in 3 different technologies***




***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***

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

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# Thank you!

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