

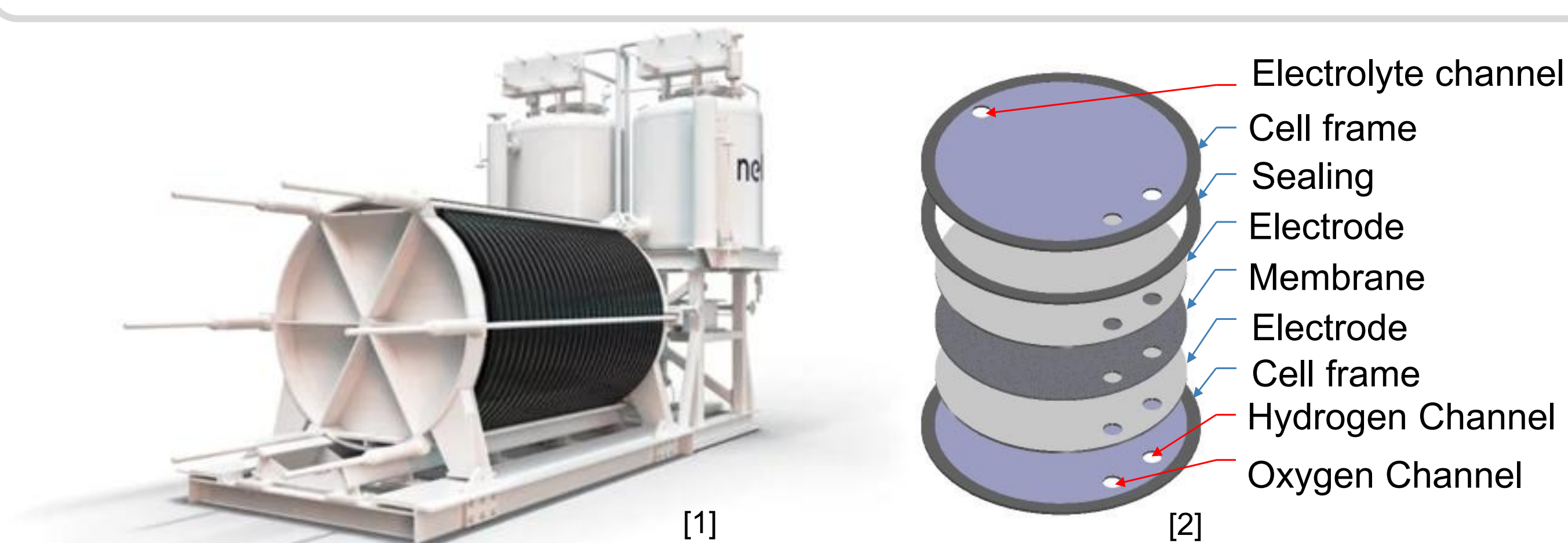
Investigation and evaluation on the mechanical and chemical behavior of adhesives in strong alkaline environment

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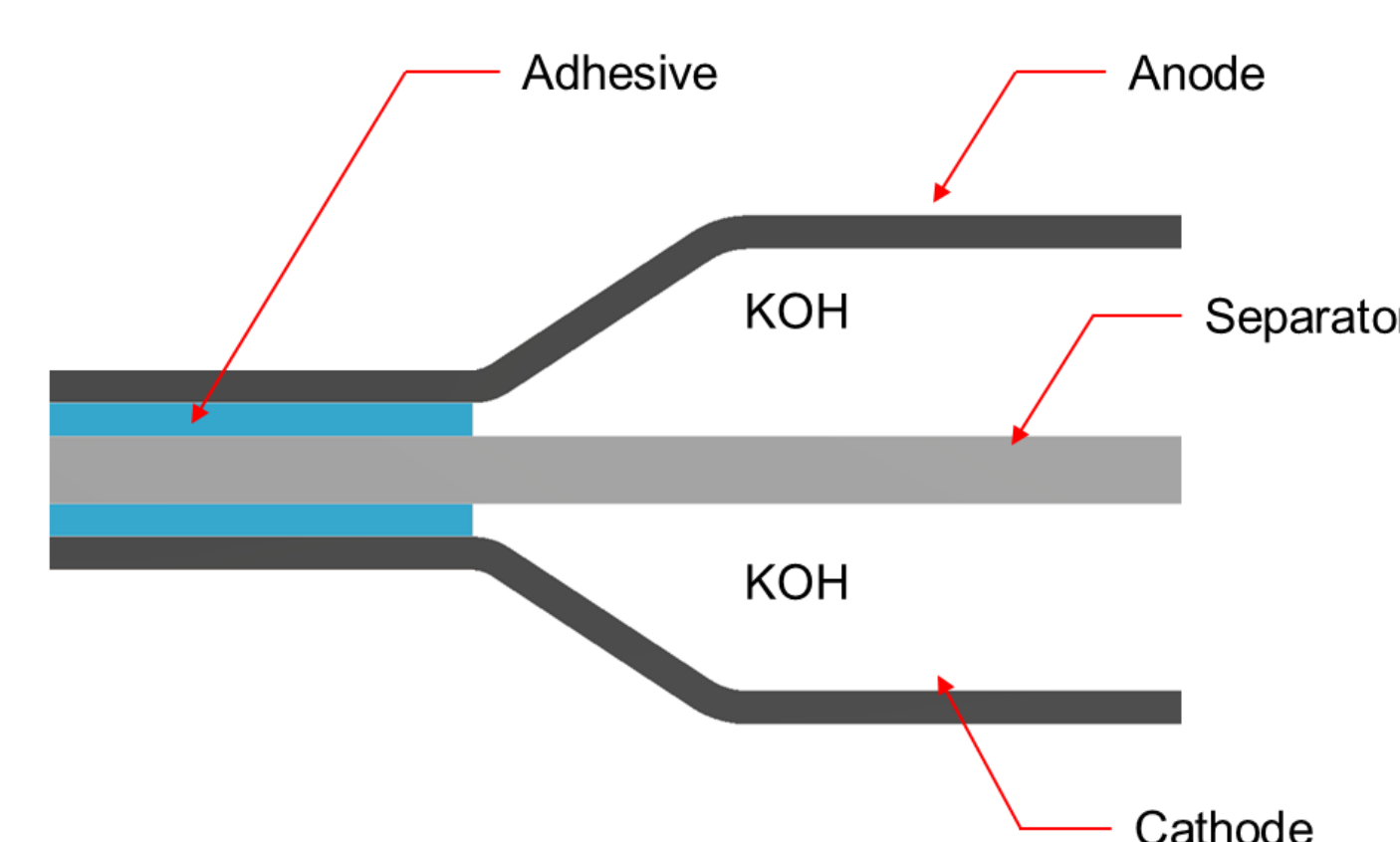
INTRODUCTION

- The Paris Climate Agreement calls for **carbon neutrality by 2050**
- Rising demand of hydrogen** as a promising option for storing green energy
- Electrolyzers are **still expensive** because of precious materials and manual production processes



APPROACHES & CHALLENGES

- Adhesive bonding could offer **sealing and force transmitting tasks** in one, while being a **highly automatable process**
- Aggressive operating conditions** (up to 90 °C at 35% KOH)
 - Hydrolysis of the polymer network



➤ Aim of this work: Investigation on bulk adhesive behaviour under alkaline water electrolysis aging conditions

MATERIALS

- Different 1-component and 2-component **epoxide adhesives** were selected with different chemical compositions.
- Ageing was performed for **7 days in 35 % KOH at 90 °C**

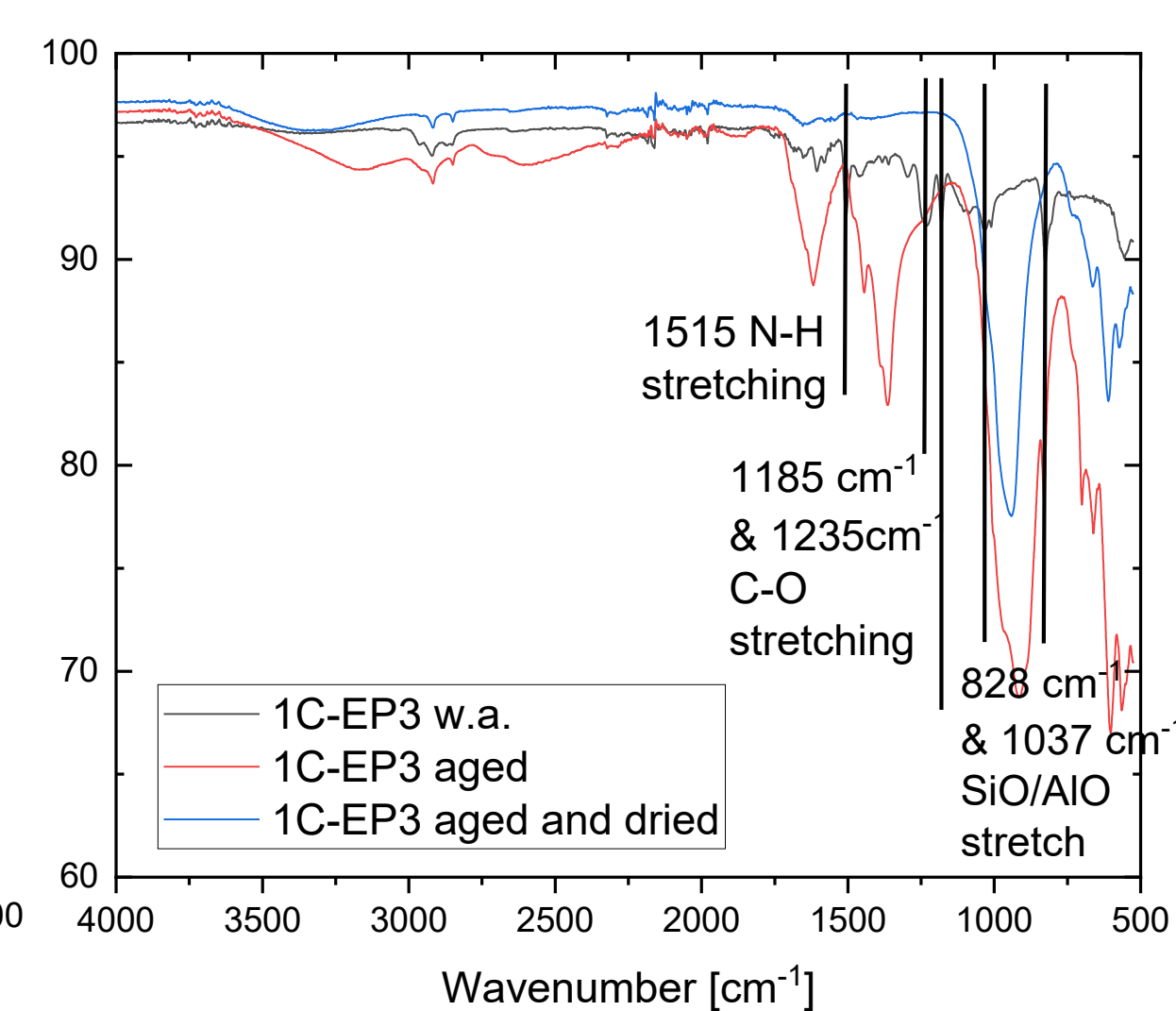
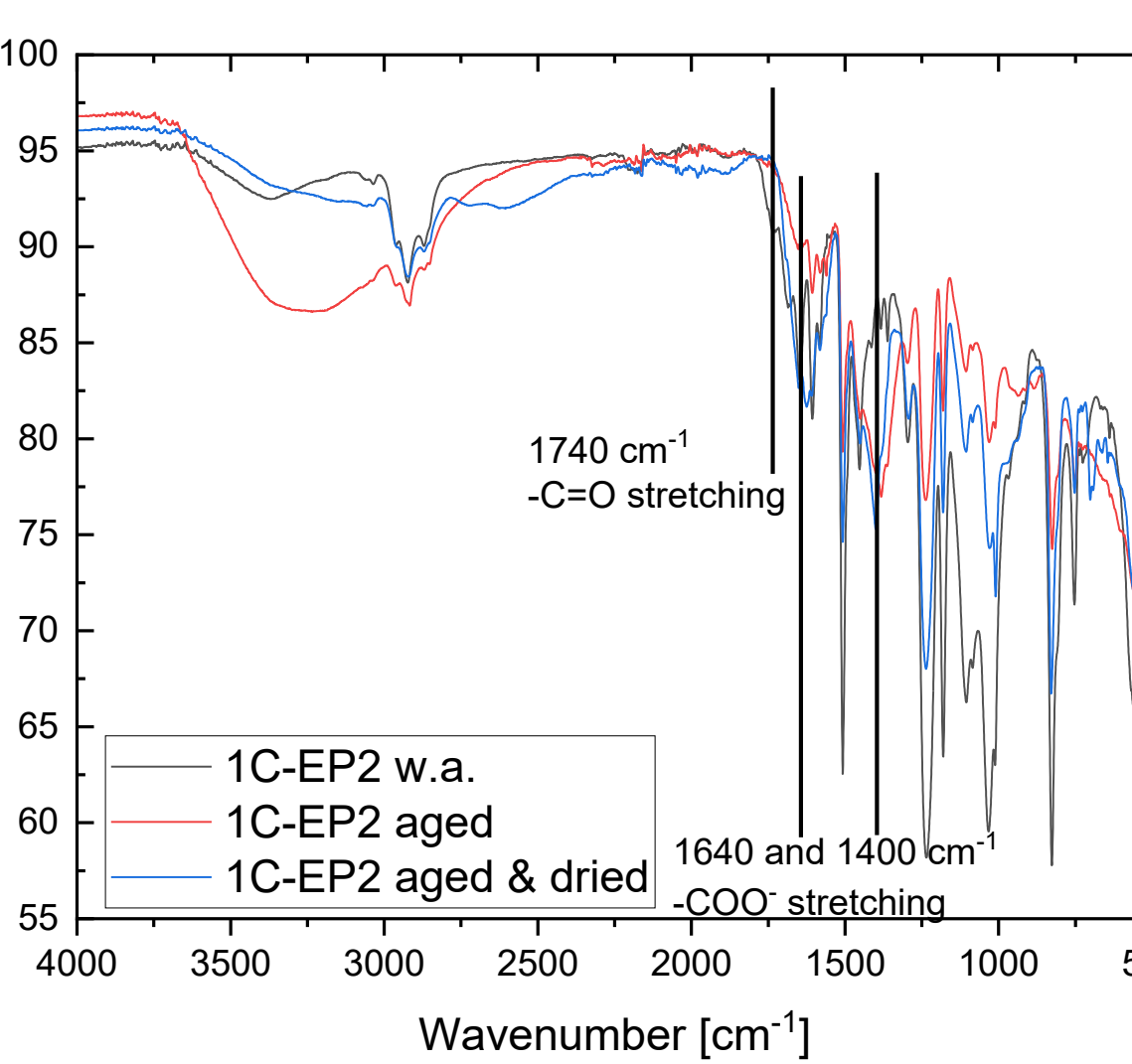
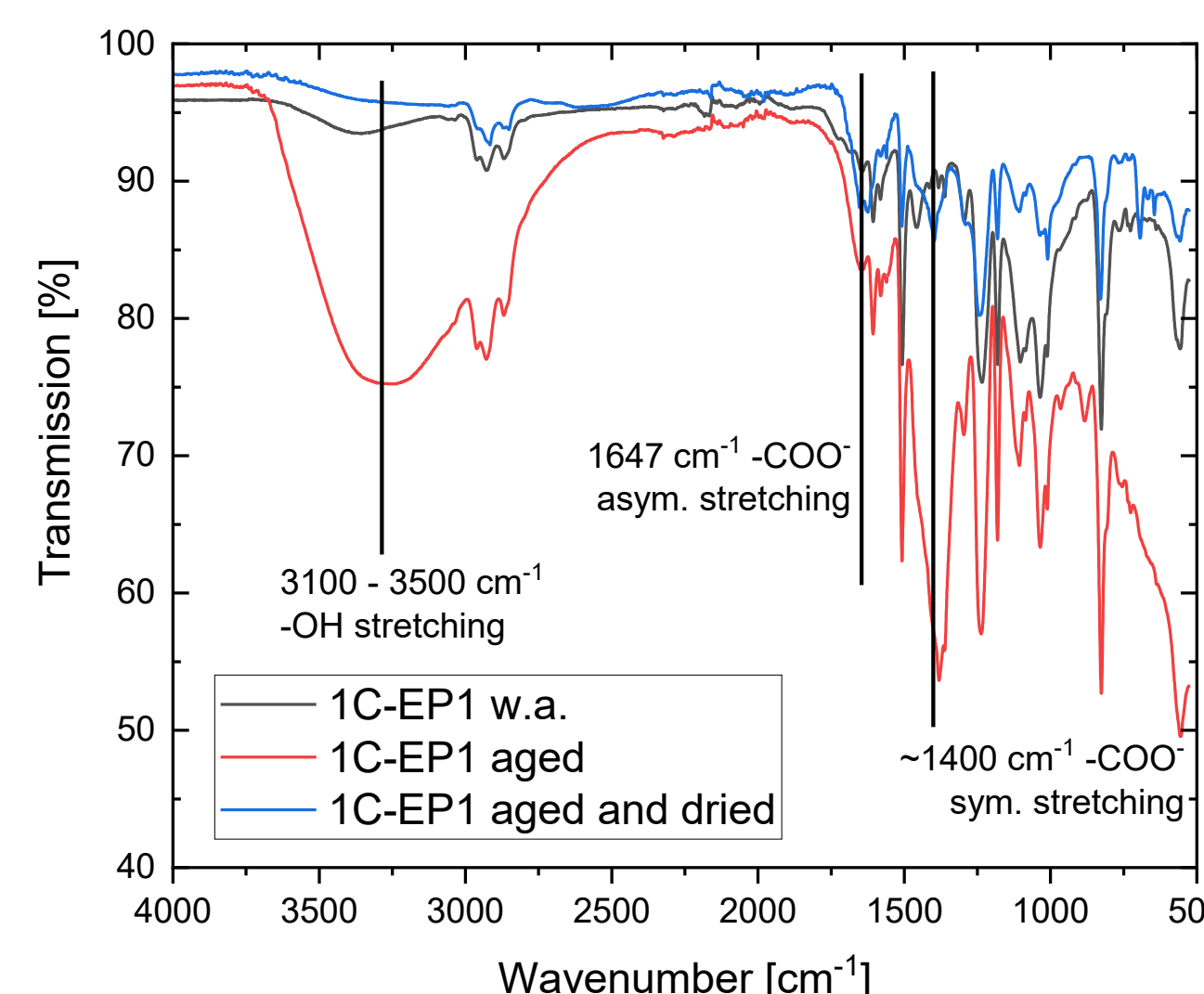
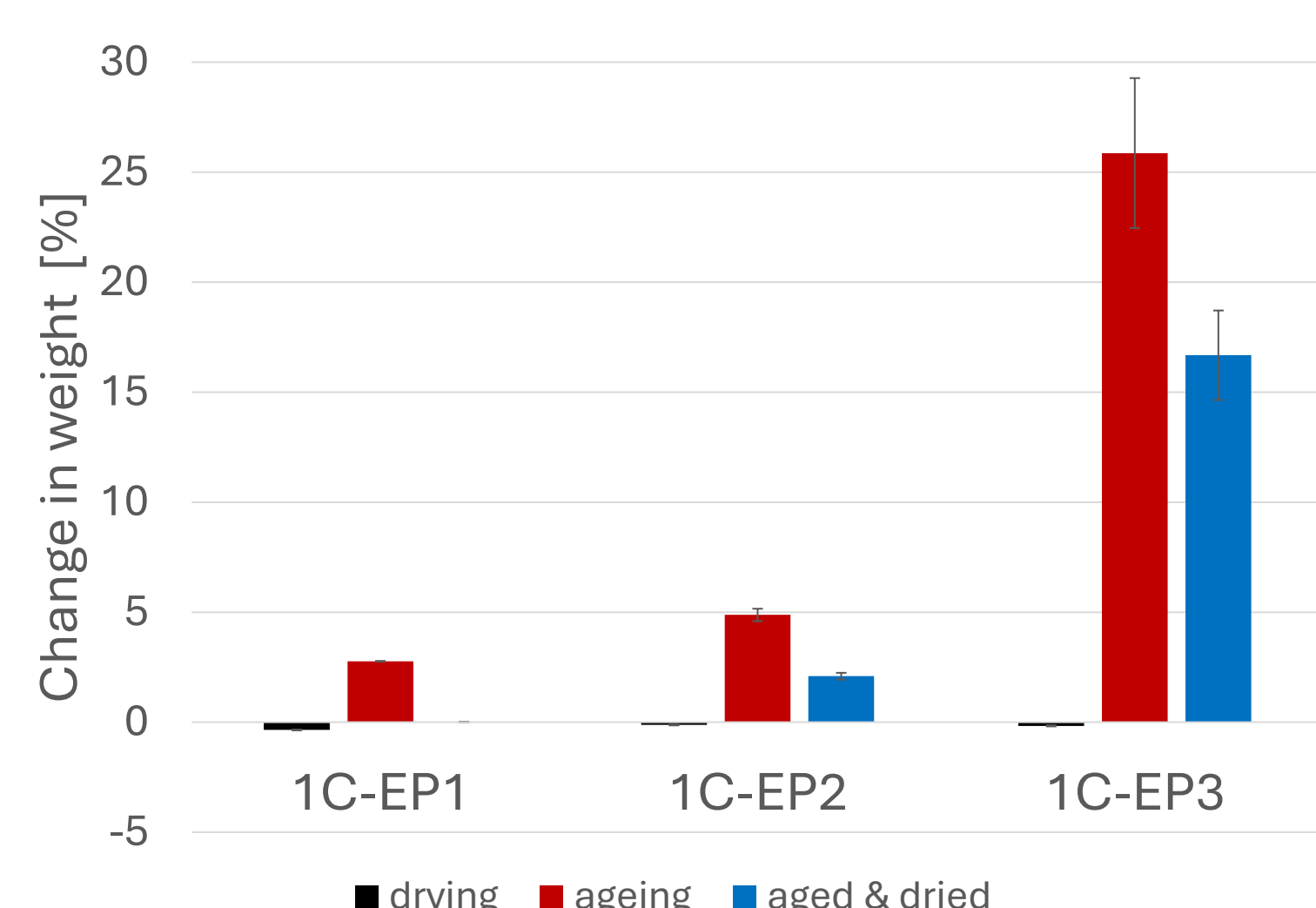
1C-EPs

Adhesive	Chemical components
1C-EP1	
1C-EP2	
1C-EP3	

2C-EPs

Adhesive	Chemical components
2C-EP1a / 2C-EP1b (with sheet silica)	
1C-EP2	
1C-EP3	

RESULTS



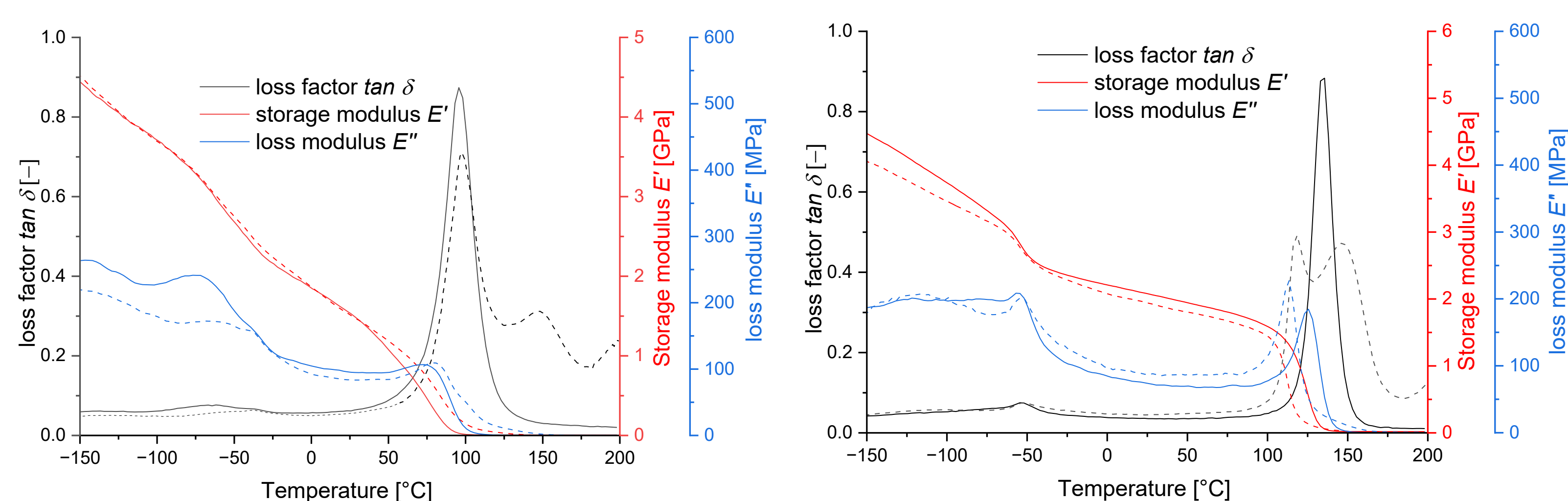
CONCLUSION:

Specific components are unstable at operating conditions for AEL-electrolyzers e.g.:

- Urea-hardeners
- Esters (neodecanoate)
- unsaturated fatty acids
- Fillers (Al(OH)₃ or amorphous silica)

A single method is not sufficient for understanding the ageing of adhesives in this environment

Only cohesion was evaluated, interfacial behaviour needs to be evaluated specifically

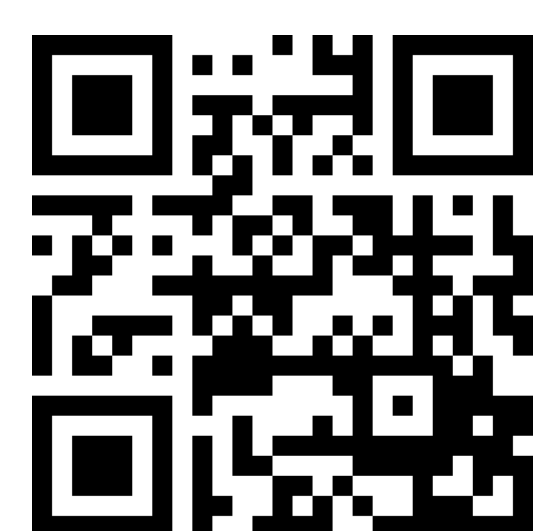


Sources:

[1] <https://nelhydrogen.com/market/hydrogen-production/> (Last access: 29.06.2025)

[2] Koj, Matthias: Entwicklung und Charakterisierung von Elektroden für die Sauerstoffentwicklung in der alkalischen Wasserelektrolyse. TU Clausthal. Clausthal-Zellerfeld 2021

[3] <https://transmet.com/products/aluminum-flakes/> (Last access: 29.06.2025)



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