



Delft University of Technology

Analyze Electrolyzers with EIS and EECs

Selection and interpretation of PEMWE electrical equivalent circuits

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Publication date

2023

Document Version

Final published version

Citation (APA)

Broer, A., Garcia Torregrosa, I., & Van Dijk, B. (2023). *Analyze Electrolyzers with EIS and EECs: Selection and interpretation of PEMWE electrical equivalent circuits*. Poster session presented at European Fuel Cell Forum, Lucerne, Switzerland.

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Electrodes or...

Most scholars link **Voigt elements** (RQ combination) to **electrodes**

There is no consensus on which Voigt element is cathode/anode

Three scholars explicitly **reject** linking RQ sets to electrodes



Adaptable EECs

In six publications, the EEC was adapted depending on the EIS data

An extra Voigt element was added to account for:

>> **Mass transport** limitations

>> Operating at **high current densities**

Interpretation of EECs

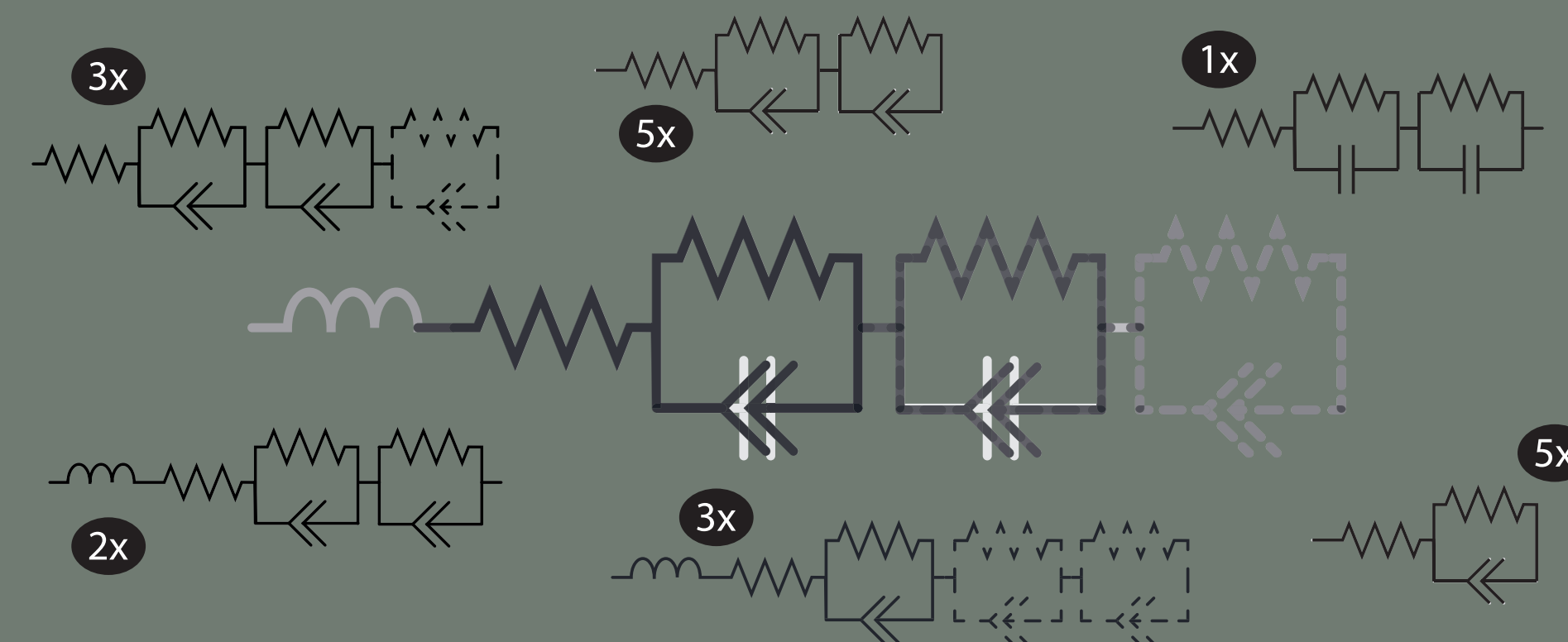
Authors assign different meanings to circuit elements. This figure demonstrates the two main interpretations.



■ Charge transfer electrode ■ Specified boundary/process
■ Double layer electrode ■ Ohmic resistance cell

Overlay figure EECs

From the 21 EECs, 19 have a very similar build up. These are stacked in the figure below, revealing the common core R-RQ-RQ structure.



R-RQ-RQ most common

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*Selection and interpretation
of PEMWE electrical
equivalent circuits*



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Find the best fit

EECs should be fitted based on the **type of PEMWE** and **operational conditions**

Common **interpretations**:

- > Resistor (+ inductor) for ohmic resistance
- > Electrodes represented by Voigt elements
- > Voigt element in case of mass transfer limitations



Resistor
(R)



Capacitor
(C)



Inductor
(L)



Warburg element
(W)



Constant Phase Element
(CPE)



Motivation

Limited lifetime is an issue that keeps PEM water electrolyzers (PEMWE) from scale-up to MW and GW scale

Electrochemical Impedance Spectroscopy or **EIS** is a key technique to analyse PEMWE

Electrical Equivalent Circuits (**EECs**) aid interpretation of EIS data, but there is **no consensus** on which configuration to use

Improve EIS interpretation

Review method

Scopus search **key words** used: EEC, PEMWE, EIS

Get in touch!

Our final review is still under construction. Find our contact details here if you want to **collaborate**!

33 publications reviewed

