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Experimental analyses of MEA durability using load cycling and accelerated stress tests in heavy-duty conditions

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The PEMTASTIC project [1] is focused on the development of durable heavy-duty (HD) membrane electrode assemblies (MEAs). In order to enable this development, investigations using application-relevant load cycles as well as accelerated stress tests (ASTs) are necessary. These tests are accompanied by electrochemical in-situ and physico-chemical ex-situ analyses.

This presentation introduces the approach of the performed analyses, their results and possible conclusions (Figure 1). This includes the development of an open-source HD load cycle and HD relevant test conditions as well as their use for the analysis of the local degradation behavior at different positions of the active area in a PEMFC stack (air-inlet and air outlet). Additionally, sensitivity tests and ASTs focusing on single parameter changes (voltage range, temperature, and relative humidity) are used to improve the understanding of degradation mechanisms and enable parameterization and validation of degradation models. The tests are completed by a comparison to the AST developed by the Million Mile Fuel Cell Truck (M2FCT) project [2]. In PEMTASTIC, the MEAs are developed in several generations. A comparison of the various analysis methods for different MEA generations will be used to demonstrate which material and structural parameters are important for the development of a durable HD-MEA and to improve the understanding of degradation mechanisms.

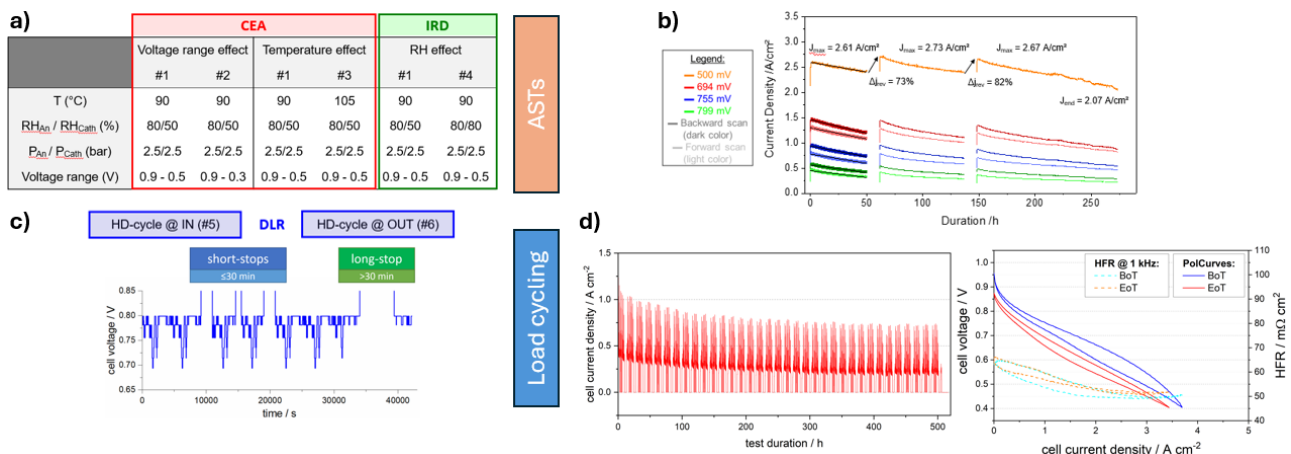


Figure 1: Test approach (a) and exemplary results (b) for AST tests as well as test approach (c) and exemplary results (d) for HD-representative load cycling tests.

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REFERENCES

- [1] <https://pemtastic-project.eu/>
- [2] <https://m2fct.org/ast-protocols>