## Understanding heterogeneities in Direct Methanol Fuel Cells – A modelling approach

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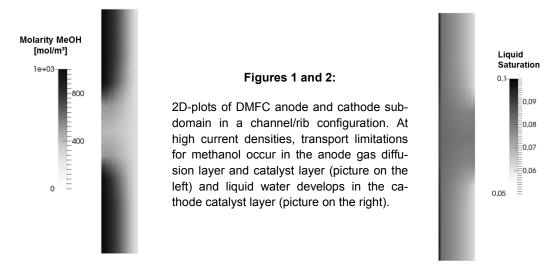
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Among the technologies for alternative power sources, Direct Methanol Fuel Cells (DMFCs) are a promising option for the power supply of portable devices. Methanol and water can be supplied as a liquid, which is an advantage for certain applications. During operation, gaseous carbon dioxide is generated on the anode and liquid water is generated on the cathode, causing a two-phase flow within the cell. This behaviour leads to a rather heterogeneous distribution of species which needs to be modelled accurately.

We present a transient, two-dimensional DMFC cell model that includes multicomponent transport in gas and liquid phase as well as electrochemical phenomena. The model is implemented in our in-house CFD code *Neopard-FC*, which is developed at DLR based on the open-source-software DuMuX<sup>1</sup>. A multiphase and multicomponent Darcy-approach is used for modelling the flow in porous GDL and CL on anode and cathode. The model describes a cross-section of a MEA and includes methanol and water crossover through the membrane. Electrochemical reactions are described with Butler-Volmer-type equations and the mixed potential at the cathode is taken into account.

With this 2D-model we aim to understand the formation of heterogeneities within a DMFC single cell under various modes of operation and their effect on the cell performance and degradation. Comprehension of the local conditions inside a DMFC is important for improving cell design and operating strategies in order to enhance cell performance and durability.



## **References:**

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