Hydrogen: A Promising Energy Carrier for Electromobility

Electromobility has received important attention in the last few years, but its perception by the public and decision makers is often limited to battery powered vehicles. Alternatives such as hydrogen fuel cells should however be taken into account, as their specific advantages (in particular short refueling times) make electromobility as a whole acceptable by a much broader public. Within the SCCER Mobility, PSI and ZHAW work on a novel fuel cell concept aiming at reducing the major limitation to the deployment of fuel cells: their cost.

Introduction

Battery and hydrogen fuel cell vehicles both feature an environmentally attractive option for mobility:

- Free of emissions (CO₂, NOₓ, soot) on the local scale.
- On the global scale, important potential for CO₂ emission reduction (easy integration with renewable sources).

Currently, the major requirement for a large scale deployment of these technologies is a reduction of their cost.

Advantages and drawbacks of fuel cell and battery electric vehicles

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<thead>
<tr>
<th>Requirement</th>
<th>Fuel Cell Electric Vehicle</th>
<th>Battery Electric Vehicle</th>
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<tbody>
<tr>
<td>Cruising range</td>
<td>+</td>
<td>-</td>
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<tr>
<td>Charging/refueling time</td>
<td>++</td>
<td>–</td>
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<tr>
<td>Heavy duty traffic</td>
<td>+</td>
<td>–</td>
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<tr>
<td>Primary energy need</td>
<td>+</td>
<td>++</td>
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<tr>
<td>Cost</td>
<td>–</td>
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Cost reduction: Novel evaporatively cooled fuel cell design

In conventional fuel cell systems, a vapor exchanger for humidification and a separate coolant loop are required.

FC system with evaporative cooling

Humidification and cooling by water injection, simplifying the system and removing costly components. The distribution of injected water is challenging.

Our specific approach

Within the SCCER Mobility, we use a novel material with patterned wettability developed at PSI [1]. It allows to finely distribute the water without blocking the access of hydrogen and air.

Results and outlook

- Development conducted as a combination of experimental work at PSI and numerical simulations at ZHAW.
- Proof of concept realized with a laboratory cell during the 1st phase.
- Demonstrator on the kW scale in progress during the 2nd phase.

References


Partners