PEM Fuel Cell Durability

Problem of Durability
Due to corrosion of catalyst supports
From maldistribution of reactants across cell
Maldistribution due to accumulation of water in flow channels

critical hurdle in automotive fuel cell deployment

<table>
<thead>
<tr>
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<th>DOE Target</th>
<th>Current State</th>
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<tbody>
<tr>
<td>Stationary</td>
<td>40,000 hrs</td>
<td>20,000 hrs</td>
</tr>
<tr>
<td>Automotive</td>
<td>1,500 hrs</td>
<td>5,000 hrs</td>
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Water in the Flow Field

- problem is not the presence of the water
- problem is the water does not easily move

- contact line pinning
- contact angle hysteresis
Use Inertia to Break Pinning

liquid inertial is available even for very small drops

4 mm diameter

Use inertia to assist with water motion via excitation at natural frequency

US Patent Application #11/894,335
Surface Oscillations Easily Generated

Water Plug Response to 140 Hz Acoustic Wave

Water Plug Response to 0 Hz
Fluidic Amplifiers/Oscillators

- right Control Port deflects supply to **left** Exhaust Port
- pressure feedback from left exhaust to left Control Port deflects supply to **right** Exhaust Port
- pressure feedback from right exhaust to right Control Port deflects supply to **left** Exhaust Port
Fluidic Oscillator Experiments

Effect of Feedback Tube Length on Amplifier Frequency

- 6 in feedback
- 8 in feedback
- 11 inch feedback

Amplifier Frequency (Hz)

Input Pressure (psig)

frequency
Fluidic Oscillator Design

Development stopped in early 1970's due to lack of computational capability.

Current computational code (KIVA) can handle transonic flow.

Can enable development of optimized, non-vented oscillator.
Objectives

License Technology

Develop Non-Vented Amplifiers

Work with OEM to integrate into PEM flow field & performance testing

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