Experimental analysis of Gas-liquid flow in PEM water electrolysis micro-channels using a permeable wall (poster)

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Experimental analysis of Gas—liquid flow in PEM water electrolysis micro-channels using a permeable wall

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Introduction

One means of reducing the cost of PEM electrolyser is to increase production from the existing cells by increasing the current density from 1 (A/cm²) (at the existing conventional cells) to more than 5 (A/cm²). At high current densities, due to high rate of oxygen generation and concentrated heat generation in the cell, issues related to heat and bubble management come up which must get managed.

Experimental Setup

The micro-porous ceramic plate simulates generates tiny bubbles simulating the real membrane electrode assembly (MEA). The movement of bubbles upward in the micro-channel at a specific stoichiometric number is analysed and its multiphase flow regime is identified. The channels size is 0.5 x 1 mm. To take images of the gas—liquid flow, a high-speed AOS camera is set in front of the setup. Two high power LED is used on besides of the camera to bright the view. The bubbles forms in the channels aren’t clearly visible in the raw images. Therefore, a code is written in MATLAB to emphasize the bubble borders based on their movement.

```matlab
vid = VideoReader('exp-1.avi');
mov = read(vid);
mov2 = diff(mov,1,4);
mov3 = mov2*10;
```

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Results

The following figure shows Taylor bubbles in the outlet channel. About 0.6 mm of the Taylor bubbles are in contact with the micro-channel wall. The aim of the following figure is to show accumulation of tiny bubbles in the upper section of the Ti-felt.

![Fig. 6: Taylor bubbles in the outlet channel. About 0.6 mm of the Taylor bubbles are in contact with the micro-channel wall.](image)

The aim of the following figure is to show accumulation of tiny bubbles in the upper section of the Ti-felt.

Conclusion

Gas—liquid flow in micro-channels of electrolyser independent of the electro-chemical complexities was demonstrated. Different gas-liquid flow regimes was seen by different gas flow that corresponds to the current density and water flow rate was successfully demonstrated using a micro-porous ceramic as a permeable wall.

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