

Two Dimensional Hydrogen Fuel Cell: Channel Optimal Shape Design

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Abstract

A two dimensional model of dry hydrogen fuel cell, the cathode side, is considered. This part of the cell involves two layers: the air channel and the graphite diffusive layer. The objective is to find the optimal shape of the air channel such that the following constraints are met individually:

1. The oxygen distribution is uniform on the cathode membrane.
2. The total oxygen is maximized on the cathode membrane.
3. The water vapor is maximized at outlet of the air channel.
4. The pressure drop, of the inlet and the outlet of the air channel, is minimized.

Then some cases of mixed constraints are considered. These objectives are achieved by implementing shape calculus and the adjoint method.