Abstract Submitted
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Design and optimization of anode flow field of a large proton exchange membrane fuel cell for high hydrogen utilization[1] SERHAT YESILYURT, OMID RIZWANDI, Sabanci University, Istanbul — We developed a CFD model of the anode flow field of a large proton exchange membrane fuel cell that operates under the ultra-low stoichiometric (ULS) flow conditions which intend to improve the disadvantages of the dead-ended operation such as severe voltage transient and carbon corrosion. Very small exit velocity must be high enough to remove accumulated nitrogen, and must be low enough to retain hydrogen in the active area. Stokes equations are used to model the flow distribution in the flow field, Maxwell-Stefan equations are used to model the transport of the species, and a voltage model is developed to model the reactions kinetics. Uniformity of the distribution of hydrogen concentration is quantified as the normalized area of the region in which the hydrogen mole fraction remains above a certain level, such as 0.9. Geometry of the anode flow field is modified to obtain optimal configuration; the number of baffles at the inlet, width of the gaps between baffles, width of the side gaps, and length of the central baffle are used as design variables. In the final design, the hydrogen-depleted region is less than 0.2% and the hydrogen utilization is above 99%.

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