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Charge and Discharge Characteristics of a Membraneless Hydrogen Bromine Laminar Flow Battery

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Electrochemical energy storage systems have been considered for a range of potential large-scale energy storage applications.[1] Although the market need for such technologies is well known, existing technologies are still too expensive to compete with conventional combustion-based solutions.[2] Recently, polymer electrolyte membrane-based electrochemical cells utilizing hydrogen and bromine have been investigated for their potential as a highly efficient and low cost energy storage technology, but the cost, durability, and conductivity of existing ion exchange membranes were identified as barriers to successful commercialization of the technology.[3,4]

In this work, the charge and discharge performance characteristics of a membraneless hydrogen bromine laminar flow battery (HBFLB) are theoretically and experimentally examined. The HBLFB concept builds upon recent laminar flow fuel cell work by relying on the dynamics of laminar flow to ensure reactant separation, as shown in **Figure 1**.[5-7] By eliminating the need for a membrane, the HBLFB has the potential to decrease costs and increase durability compared to traditional membrane-based hydrogen bromine systems, while also producing room temperature discharge power densities in excess of 700 mW/cm^2, as shown in **Figure 2**.

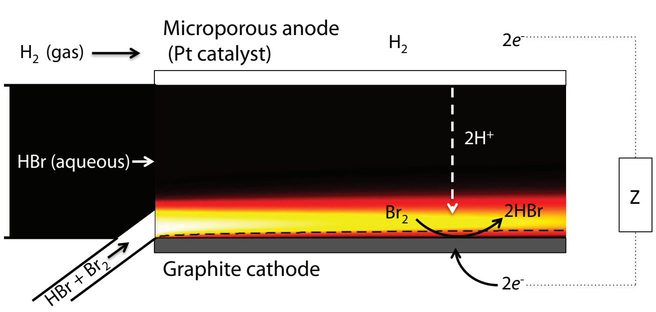

Figure 1. Operating schematic of the HBLFB during discharge mode.

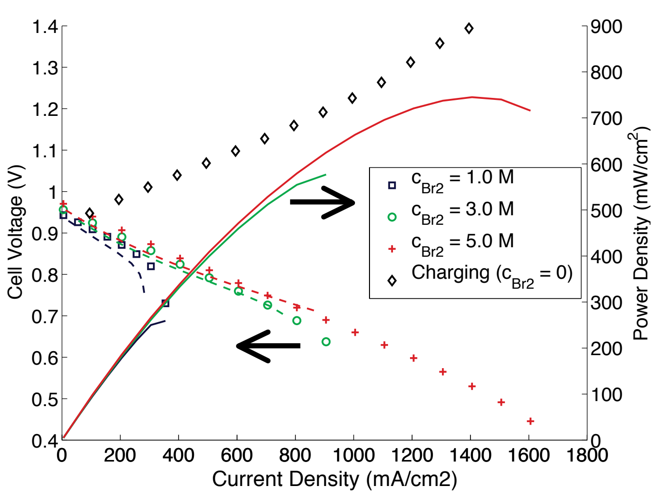

Figure 2. Charge and discharge performance of the HBLFB with an electrolyte concentration of 3 M, and a bromine flow rate of .44 mL/min/cm^2. Predicted discharge data based on numerical simulation is shown as dashed lines.

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