

## Comparison of Acid and Alkaline Hydrogen-Bromine Fuel Cell Systems

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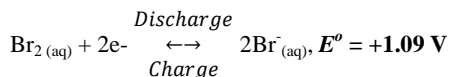
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### Abstract

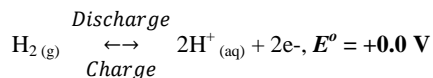
The hydrogen bromine (H<sub>2</sub>-Br<sub>2</sub>) fuel cell system is an attractive system for electrical energy storage because of its high round-trip conversion efficiency, high power density capability, and anticipated low costs.

The hydrogen-bromine fuel cell system can be operated in the acid or alkaline modes. The charge and discharge electrode reactions in an acid H<sub>2</sub>-Br<sub>2</sub> fuel cell system are as follows:

#### Bromine Electrode:

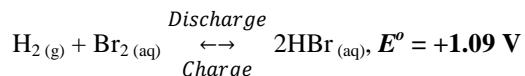


#### Hydrogen Electrode:



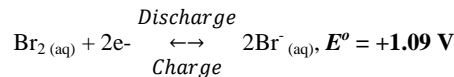
The H<sup>+</sup> ions migrate from the hydrogen side across a proton conducting membrane to the bromine side during discharge to combine with the Br<sup>-</sup> ions to form hydrobromic acid.

#### Overall Reaction:

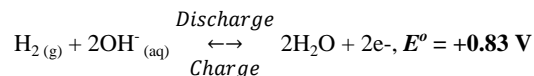


The charge and discharge electrode reactions in an alkaline H<sub>2</sub>-Br<sub>2</sub> fuel cell system are as follows:

#### Bromine Electrode:

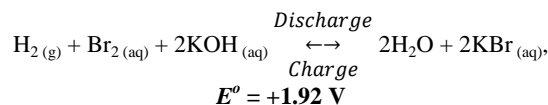


#### Hydrogen Electrode:



The cations (e.g., K<sup>+</sup>), associated with the OH<sup>-</sup> ions, migrate from the hydrogen electrode across a cation (K<sup>+</sup>) conducting membrane to the bromine side and combine with the Br<sup>-</sup> ions to form KBr as shown in the overall reaction.

#### Overall Reaction:



Based on the reactions shown above the alkaline system offers a higher cell voltage, which is an advantage because of potentially higher power output. However, the hydrogen reactions in this system are two-phase reactions involving gaseous hydrogen and liquid-phase hydroxide ion reactants and will require more complex electrode structure and fuel cell design. The other advantages of this system include the fact that non-noble catalysts can be used for the hydrogen reactions and lower corrosiveness.

This presentation will discuss the advantages and disadvantages of the alkaline and acid H<sub>2</sub>-Br<sub>2</sub> fuel cell systems and compare the discharge and charge performance of both systems.

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