FUEL CELL

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Abstract –

Our project is basically a cell which will help us to reduce the use non-renewable energy resources. In this project, one will explore a cutting-edge method for storing renewable energy by breaking water molecules into hydrogen and oxygen.

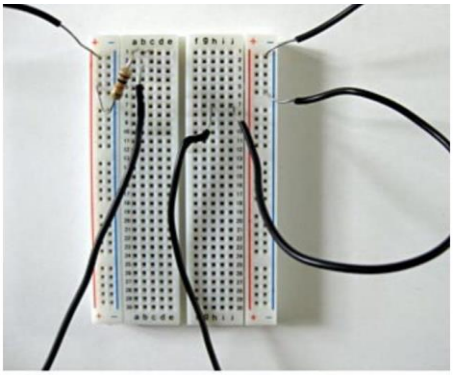
It consists batteries, breadboard, nickel plates and some chemicals.

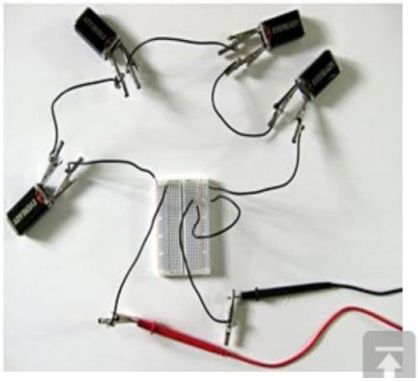
Materials Required-

1. 9V batteries
2. 22 gauge wire
3. Alligator clips
4. Breadboard
5. Digital multimeter
6. Styrofoam
7. Nickel metal strips
8. Cobalt nitrate hexahydrate
9. 0.1M phosphate buffer solution with ph7

Procedure-

1. Build a circuit on the breadboard consisting of the batteries, resistors and multimeter as shown in figure1.





2. Use the nickel metal strips as electrodes. The nickel electrodes will serve as the scaffold for electroplating of the cobalt catalyst.
3. Construct a method to secure electrodes within a small beaker or jar that leaves the top of the electrodes readily available to make an electrical connection to the rest of the circuit we started preparing above.

4. Add 0.1M phosphate buffer solution, pH 7.0 to the beaker with electrodes so that the nickel electrodes are submerged half way in buffer solution.
5. Connect the nickel electrodes to the rest of the circuit using copper wire and alligator clips.
6. After that we have to add the cobalt catalyst and measure its effects. With the electrodes securely place inside the small beaker, place the beaker in magnetic stir plate. Turn on stir plate and get stir bar moving at constant rate.
7. Monitor the voltage readout on the voltmeter or multimeter, this measured voltage is baseline voltage of our electrochemical cell.
8. We calculate the baseline efficiency of water splitting reaction in the electrochemical cell.
9. Now add the reactant necessary to form the cobalt-based catalyst. With the cobalt source and the energy provided by the batteries, the catalyst will start to form.
10. The cobalt-based catalyst will begin to electroplate onto the anodic nickel electrode. As the catalyst film grows, we will see a brown film growing on the anode, and the voltage readout on the voltmeter/multimeter will slowly drop. Eventually, after several minutes, the voltage will settle to a stable reading.
11. Once the voltage readout stabilizes, we can add more cobalt nitrate to the solution to initiate formation of more cobalt-based catalyst. Again, addonly a small amount of cobalt nitrate at a time.
12. Repeat step 11 until the voltage does not appear to change with the addition of more cobalt nitrate. In this instance, the cobalt-based catalyst will continue to work, but no additional catalyst material will form.
13. Use a permanent marker to make a mark on the side of the beaker where the phosphate buffer solution level is.

References –

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Fuel Cells from fundamentals to applications by Supramaniam Srinivasan.

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