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Efficient Solar-Powered Hydrogen Production

Although renewable energy sources are an environmentally friendly substitute for fossil fuels, their intermittent nature marks them as a less desirable method for producing electricity. The answer to storing energy from renewable sources while they are available can be found in hydrogen production. In this project, a series of experiments were conducted to determine and analyze the impact on efficiency of several variables involved in solar-powered electrolysis. Experiments 1, 2, and 3 tested the impact of the membrane material, temperature, and distance between electrodes to the voltage while producing hydrogen. Experiment 4 compared the yield of hydrogen gas production to theoretical values. Experiment 5 characterized the solar cell voltage-current relationship. Experiment 6 was to complete the system by using solar cells as the current source with the arrangement that was expected to require the lowest voltage for a given current flow. The results were compared to theoretical values based on the characterized formulas of the solar cells and electrolysis cell. The data not only revealed that a high temperature, porous material, and close connection between electrodes yielded the least voltage required to maintain a constant current, but also revealed several variables in electrolysis that can further be investigated to significantly improve its overall efficiency. For the final arrangement, the electrolysis system and solar cells confirmed an agreement with theoretical values. As a result of this experiment, it is demonstrated that careful consideration of these parameters can significantly affect the efficiency and cost-effectiveness of obtaining hydrogen from renewable sources.