High performance plasma electrolysis reactor for hydrogen generation using a naoh-methanol solution

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Abstrak

In the plasma electrolysis process, hydrogen generation around the cathode is affected by the amount of evaporation energy. Utilizing a veil, minimizing the cooling in the liquid phase, and maximizing the cooling in the gas phase become important parameters to improve the process efficiency of hydrogen production. This research aims to obtain an optimum high-efficiency electrolysis plasma reactor based on decreased energy consumption and increased hydrogen gas production. The research method varied the NaOH concentration, voltage, veil length, cathode depth, and the volume of the methanol additive. In characterizing the current and voltage, as the concentration increases, the voltage needed to form the plasma will decrease. As the concentration and voltage increase, the rate of production, hydrogen content percentage, and the hydrogen ratio also increase, while the energy consumption decreases. The optimum condition, based on variations of veil length, is 5 cm when the depth of the cathode is 1 cm below the surface of the solution. Improving the efficiency of the hydrogen production process can be done by adding methanol. The best result was achieved using 15% volumes of methanol additive in 0.01 M NaOH, and higher hydrogen-ratio plasma-electrolysis results were found in comparison with Faraday electrolysis: the hydrogen ratio was 151.88 mol/mol, the lowest energy consumption was 0.89 kJ/mmol, and the highest hydrogen production rate was 31.45 mmol/min. The results show that this method can produce hydrogen 152 times more than Faraday electrolysis.