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DESIGN OF DIRECT COUPLING ADVANCED ALKALINE ELECTROLYSIS AND FUEL CELLS SYSTEM

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ABSTRACT

Proton exchange membrane fuel cell (PEMFC) is regarded as the most competitive candidate to replace the traditional forms of power conversion because of its prominent characters. Hydrogen is used as a fuel in the fuel cells and it can be produced by water splitting process or known as electrolysis. In this paper, thermodynamic model for design and optimization of direct coupling advanced alkaline electrolysis and PEMFC system (DCS) is presented. Moreover, the performances of the direct coupling system (DCS) are evaluated using numerical model that are built in Engineering Equations solver software. So, several parameters concerning the (DCS) such as the voltage of system, the hydrogen rate production from electrolysis which injection to fuel cell and producing power of the full system. The simulations result show that, the voltage of alkaline electrolysis is higher than the fuel cell. The water management process in the whole system is considered satisfactory as a result of the lack of quantity losses. Thus, the electrolysis cell does not need to inject more water; only the water generated from the fuel cell is injected to electrolysis. The efficiency of the system is 35% and this efficiency is satisfactory compared to other systems of power generation as this percentage is due to clean, renewable and environmentally friendly fuel. Unlike the other systems that cause large losses in fuel at the generation stages, as the fuel in this order is renewed within the units due to the process of reverse chemical reaction between the electrolysis cell and the fuel cell.

Keywords: (PEMFC) Fuel cells, Alkaline electrolysis, Parameters performance of full system.