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Modeling and simulation of a fuel cell of polymer membrane for the generation of electricity

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Many investigations have positioned the fuel cells as one promising technologies in the generation of clean and efficient energy for many applications; focusing the interest of many researchers in this alternative energy. In this work, a mathematical model was developed, which allowed demonstrating the operation of a Proton Exchange Membrane (PEM) fuel cell to generate electricity by using electric and thermodynamic models. This model allowed observing the actual behavior of produced energy from significant changes in operating variables such as the humidity of the polymer membrane, the electric current and the cell temperature. Thus, values for the output voltage of the cell between 0.363 and 0.974 volts were attained when it was considered a range of operation temperature between 30 and 80°C, and the saturated membrane. Furthermore, the effect of the membrane humidity was studied in the output voltage of the cell; values about -0.287 to 0.930 volts were achieved for relative humidities between 43% to 100%; considering in both cases variations in the current density of 0.5 to 2 A/cm2. In that way it was proved that the performance of the fuel cell improves when the operation temperature rises and decreases with a reduction of this variable. Also it was possible to indicate the importance of the water content in the membrane regarding the generation of electricity, making negative voltages to a shortfall in the water content in the membrane (relative humidity under 43% and current density higher that 1.6 A/cm2).

Biography

Claudia Milena Cabrera Sanmartin is a Chemical Engineering graduate from the University of Cartagena in 2014. Recently she started her Masters studies in Environmental Science in the State University of Northern of Rio de Janeiro, Brazil; working in the area of development of new technologies and bioenergy. She worked in alternative energy sources to fossil fuels, studying the production of electricity from hydrogen in fuel cells with PEM during her undergraduate studies.

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