Simulation study of a hydrogen refueling system and its associated hydrogen generation

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ABSTRACT

In searching for an alternative fuel to replace petroleum fuels, hydrogen is rgarded as one of the most important clean energy sources. Not only in transportation applications but also in power supply applications, they all have its important roles. The major research of this thesis is for an on-site hydrogen production refueling station as well as an investigation from production, storage, and consequently to its final dispensing fueling. Argonne National Laboratory ’ s (ANL ’ s) energy simulation software, GCtool, and Matlab/Simulink software were being used for simulation of a hydrogen refueling station; practical operation modules were being established; and some practical operations of the foreign refueling stations were being investigated. Due to its huge and complicate nature, Only a hydrogen production part is being selected for validation and comparison between the experiment and simulation. In the experiment, a carbon plate, stainless steel plate and stainless steel plate coated with nickel were being selected as electrodes; the results indicated that under standard temperature and pressure conditions with 20 wt% NaOH concentration of the electrolyte and 101.35 mA/cm2 of the current density, the hydrogen yield rates were 227.5, 232.5 and 227.5 mL/min, respectively. These values were being enlarged as a commercial scale that produced 15 Nm3/hr of hydrogen for system simulation. Under an assumption of a 350 atm fueling pressure condition, the compression and storage modules would consume 2.71 kW of work energy and 0.48 kW of heat loss; if under a 700 atm pressure, it would consume 3.32 kW of work energy and 1.82 kW of heat loss.

Keywords : Water Electrolysis、Hydrogen Refueling Station、GCtool Simulation、Matlab/Simulink Simulation

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