

The Development of a Sodium Borohydride Hydrogen Generation System for Proton Exchange Membrane Fuel Cell

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Abstract

This paper develops an on-demand hydrogen generation system, which can produce hydrogen from sodium borohydride (NaBH₄) solution, to operate proton exchange membrane fuel cell (PEMFC). We first build the hydrogen generation system, which hydrolyzes NaBH₄ in a batch reactor to provide a continuous supply of hydrogen to drive the PEMFC. We also discuss the impacts of solution concentration and batch volume. In addition, we develop a simulation model that evaluates the hydrogen generation and temperature responses of the system. Furthermore, we design a control strategy to adjust the batch intervals of NaBH₄ solution according to the PEMFC loads. We then implement the designed control on a microcontroller and integrate it with a PEMFC for experimental verification. The results confirm that the developed on-demand hydrogen generation system can hydrolyze NaBH₄ with a conversion rate of more than 90% so that it to continuously supplies hydrogen to drive a 3 kW PEMFC.