

Development of 2MW PEMFC system dynamic model for hydrogen fuel cell-powered ship

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In order to satisfy regulations on greenhouse gas emissions in the shipping industry, clean energy such as hydrogen should be used as a fuel for the ship, thus research and development are needed in this area. To this end, this study designed and tested a 2MW PEMFC dynamic system for application to ships on Aspen HYSYS. Firstly, modelling PEMFC stack with its electrochemical calculations including Nernst equation, physical parameter, fuel supply and recycle, and temperature adjustments considered is done in steady state. Then, additional temperature and pressure adjustments with additional unit operations are added to separate water, air, and hydrogen effectively on Aspen HYSYS. With this, PID control of cooling water flow rate and of fuel flow rate are used to simulate dynamic behavior of PEMFC stack under various stack conditions. The model has acceptable errors, regarding to current load variation scenarios.