

Purpose of Research

—This study is developing the metal hydride (MH) cartridge. A concern with the MH is the performance drop during use—an endothermic reaction causes this problem and a decrease in the hydrogen discharge ratio. Therefore, we focus on supplying heat to MH using fuel cell exhaust gas, which is a hot air flow. We aim to increase the hydrogen discharge ratio by optimizing the cartridge structure to promote heat utilization.

Summary of Research

The cartridge consists of four tanks filled with MH, a cover, and is used in a multi-layer system (Figs. 1 and 2). In this study, we focused on the temperature distribution of the MH, which is a factor that reduces the hydrogen discharge ratio. We investigated tank arrangements that provide uniform exhaust flow and heat flux around the tanks using a computational fluid dynamics (CFD) dynamic simulator (Figs. 3 and 4).

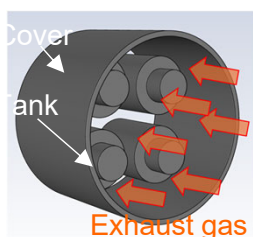


Fig. 1 The MH cartridge

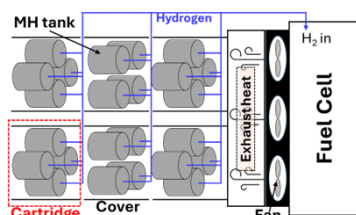


Fig. 2 Multi-layer system

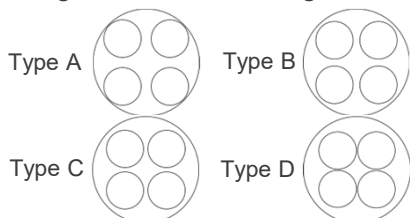


Fig. 3 Proposed tank designs

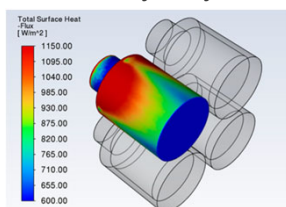


Fig. 4 Heat flux distribution in Type C

Comparison with Conventional or Competitive Technologies

- Flexible attachment/removal
- Higher hydrogen discharge ratio

Expected applications

- From mobile batteries to electric-assisted bicycles: small electric devices powered by fuel cells

Challenges in Implementation

- Determination of the cartridge size and material to increase heat utilization

Looking for the collaborative companies

- To expand the hydrogen market in the local area, we propose a small application for an FC battery with MH tanks

Points

- Utilization of metal hydride for hydrogen general use
- Thermal design using CFD

Future Developments

- 2026.12 Achievement of a hydrogen discharge ratio of 90% (Issue a patent for the cartridge structure)
- 2027.12 Foundation of the startup company based on the R&D technology (Fabless)
- 2029.4 Implementation of the pilot test of the FC battery for the practical stage

- Associated System: N/A
- Awards: N/A
- Intellectual Property: N/A
- Prototype: Yes
- Sample: N/A