第 139 回定例研究会(2012WHEC 報告会)　資料 5

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「Development of hydrogen production systems with Pd-based alloy membrane」

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Introduction

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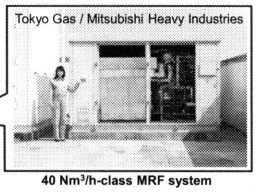
○ Membrane Reformer (MRF)

* Hydrogen production system with Pd-based H_2 permeable membrane
* Simpler, more efficient than conventional hydrogen production system(SMR+PSA)

JHFC hydrogen station in Tokyo



40 Nm³/h-class MRF system

Membrane reformer enables…

- Improvement of efficiency
- Downsizing the hydrogen production system

Enhance the advantage of the on-site distributed hydrogen production

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Conventional System and Membrane Reformer System

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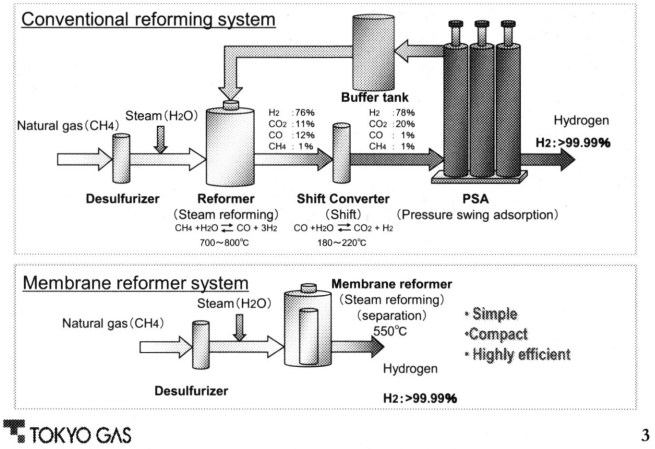

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Principle of the Membrane Reformer

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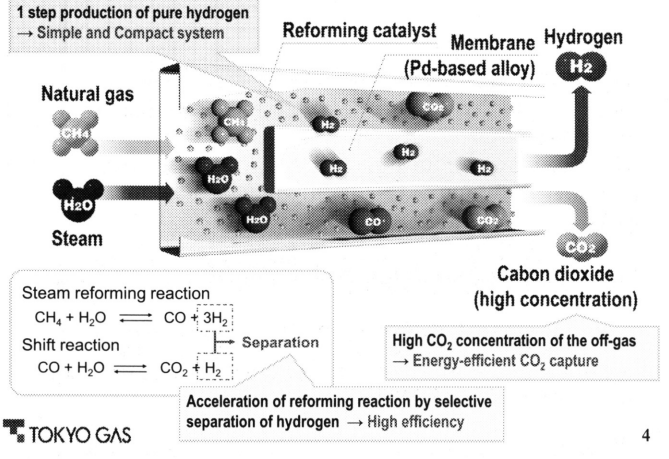

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Assembly of the membrane module

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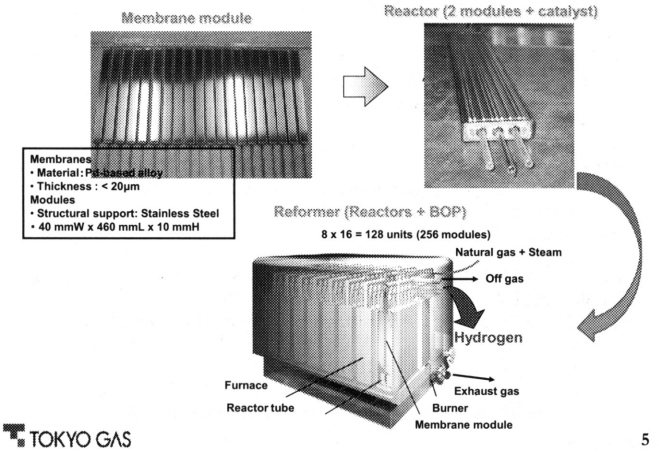

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40 Nm³/h-class MRF (Membrane Reformer) System

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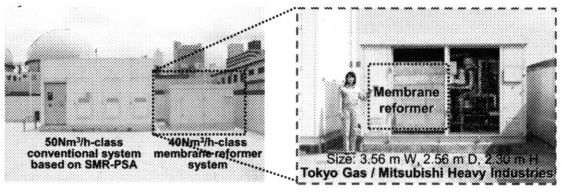

Developed the 40 Nm³/h class MRF system in 2003 and improved the performance in 2007.

○ **Achievements**

Efficiency: 81.4% (HHV)

Capacity: 40.5 Nm³/h

Purity: 99.999% (5N)

○ The efficiency of the MRF was improved by…
- Increase the membrane area
- Improve heat recovery
- Use more efficient auxiliaries

○ The efficiency of the 2nd MRF is over 80% and higher than the conventional hydrogen production system with PSA.

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Long term operation test for the 40 Nm³/h MRF

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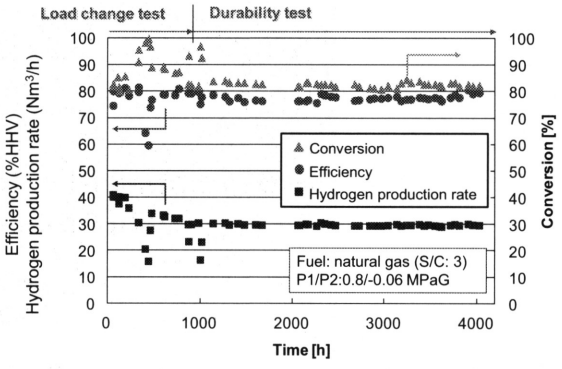

○ Conversion , efficiency, and production rate are stable in the operation.
○ For the mounted improved modules, no significant leakage has been detected.

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Membrane on Catalysts (MOC) module

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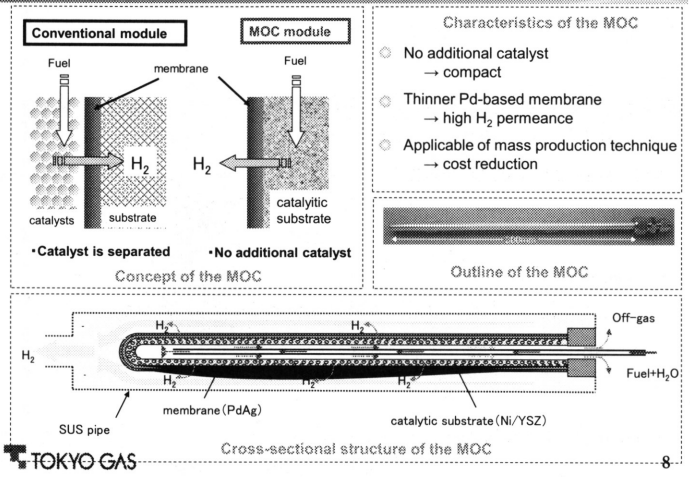

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Some causes of the leak on the MOC

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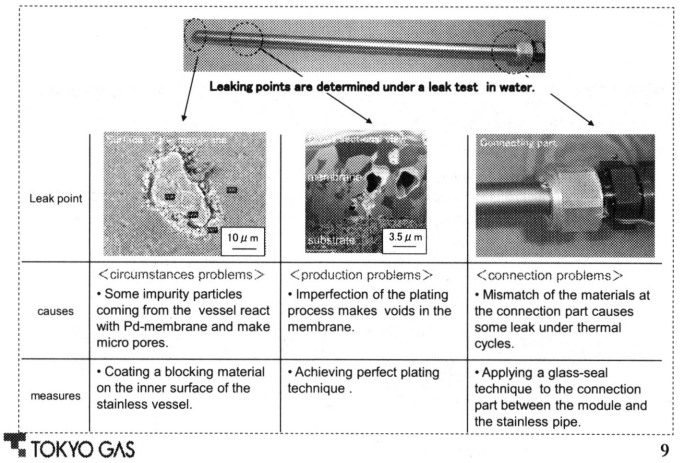

	<circumstances problems>	<production problems>	<connection problems>
causes	• Some impurity particles coming from the vessel react with Pd-membrane and make micro pores.	• Imperfection of the plating process makes voids in the membrane.	• Mismatch of the materials at the connection part causes some leak under thermal cycles.
measures	• Coating a blocking material on the inner surface of the stainless vessel.	• Achieving perfect plating technique .	• Applying a glass-seal technique to the connection part between the module and the stainless pipe.

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Long term operation for the MOC module

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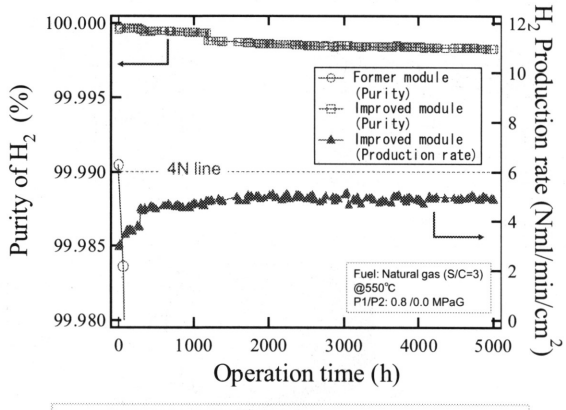

○ Modification improved the durability of the MOC module .

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Acknowledgement

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