

Status of National Project for SOFC Development in Japan

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NEDO has been promoting the R&D of SOFC since FY 1989. Until now Phase I and Phase II of the SOFC project were finished and Phase III of that is being carried out. After a basic study in Phase I, module development using planar type cells was carried out over 6 years in the 1st term of Phase II. After a mid-term evaluation in 1997, NEDO decided to continue the R&D of several kW-class modules using tubular type cells in order to improve their reliability and to lower cost in the 2nd term of Phase II. The development of 3-kW class tubular modules was successfully carried out in a relatively short period of only 3 years.

Phase III of the SOFC project planned for 4 years, was begun in FY 2001 upon successful conclusion of the development of the 3kW-class tubular module. The aim of this Phase III is to develop a thermal self-supporting module stably generating electricity by the use of SOFC exhaust heat for fuel reforming and to contribute to the realization of a practical SOFC system. In this phase, development items compose of development of thermal self-supporting modules, including the evaluation of practical systems, and elemental studies to extend technology for SOFC adaptability. Table 1 shows the targets of the development of thermal self-supporting modules. The target output is the minimum output that can continuously maintain the thermal self-supporting stage. The application of the cells to the module requires their being fabricated by a manufacturing method that reduces cell cost below or equal to that of the current sintering method, with the aim of realizing the most inexpensive cell in the world. Figure 1 shows the scheme of NEDO's SOFC R&D Program, Phase III. TOTO Ltd, is developing the thermal self-supporting modules using tubular type cells by wet process and the development of thermal self-supporting modules using MOLB type (Mono-block layer built) planar cells is carried out jointly by Mitsubishi Heavy Industries Ltd., and Chubu Electric Power Co.,. In addition, for the in elemental studies for improving cell performance, heat reliability and SOFC utilization, Tokyo Gas Co., Ltd, studies on advanced planar cells and stacks for rapid thermal operation and studies on advanced tubular type cells are being carried out by MHI.

Under Basic Technology Research Promotion Projects promoted by NEDO, TOTO also will develop a small size SOFC system with high power density using LPG and/or DME as a fuel. The specification of this system is as follows; 1) output power is about 30W, 2) the system weight is about 1.2kg, 3) the system size is 4.5*6.5*33cm.

Other developments of SOFC in Japan are as follows;

- 1) The Kansai Electric Power Company, Inc., Mitsubishi Materials Corporation and Oita University are developing a planar type SOFC using LaGaO₃ based oxide as an electrolyte in order to lower the operating temperature.
- 2) Toho Gas Corporation is developing the SOFC using Sc-TZP as an electrolyte material for the improvement of the mechanical properties of ScSZ with Nippon Shokubai Co., and Aichi Institute of Technology.
- 3) J-Power develops the 100kW-class SOFC system using the tubular type cell of MHI. In this development, the shape

of SOFC stack will be changed to the square type from the round type in order to improve the volumetric efficiency of the stack.

4) NKK has contracted to sell the SOFC systems in Japan with SWPC and FCT. This company will introduce 250kW-, 550kW-class SOFC from SWPC and 5kW- and 50kW-class SOFC from FCT to Japan.

5) Sumitomo Corporation has invested to Acumentrics Corporation and monopolized SOFC systems of this company in Japan.

Table 1. Development Targets of Thermal Self-supporting Modules

Items	Targets
Output Fuel	5 - 20 kW Natural Gas
Module Performances	1) Initial characteristics Average cell voltage; 0.7+V (200mA/cm ² , UF=75+%) 2) Decay rate < 0.25%/1,000hrs

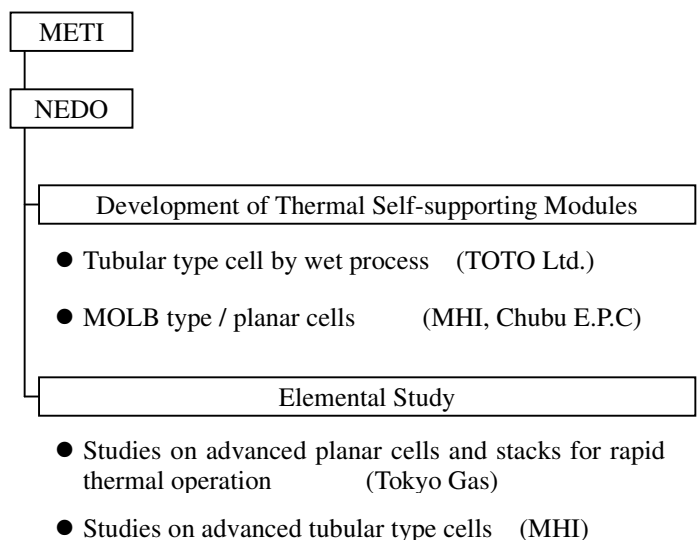


Fig 1. Project Scheme for SOFC R&D Program