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# RITE Carbon Capture Center (RCCC) for Evaluating $CO_2$ Capture Materials using Gas Boiler Flue Gas

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**Abstract**

In order to move toward decarbonization, fuel and energy sources in both the power and industrial sectors are shifting to renewable energies, but a certain amount of fossil-fuel-based thermal power generation remains to meet electricity demand, and $CO_2$ emissions are inevitable. Therefore, it is necessary to develop low-energy-consumption and low-cost technologies for $CO_2$ capture from low-pressure and low-concentration mixed gas, for example, a natural gas combustion gas of 10% or less with relatively low $CO_2$ concentration. Since 2022, RITE has been conducting the NEDO Green Innovation Fund Project for the establishment of a common evaluation standard for $CO_2$ capture materials in collaboration with the National Institute of Advanced Industrial Science and Technology (AIST). Along with the vision of the realization of a carbon neutral society, a common base for $CO_2$ capture materials will be established. The project is scheduled for nine years from 2022 to 2030 (the first stage: 2022–2024) and we will conduct the following R&D items: (a) installation and operation of the bench-scale carbon capture test center (RITE Carbon Capture Center (RCCC)) in Japan, (b) establishment of standard evaluation methods for development of innovative capture materials, (c) development of durability evaluation methods, and (d) database construction and the spread of the standard evaluation methods. RITE will formulate standard performance evaluation methods, and develop the bench-scale carbon capture test center where three different $CO_2$ capture technologies, absorption, adsorption and membranes, can be evaluated using flue gas from the natural gas boiler. In recent years, in the development of $CO_2$ capture materials for carbon neutrality, test centers for $CO_2$ capture technologies have been established throughout the world, but such a test center has not been organized in Japan, and RCCC will be the first carbon capture test center in Japan. It is expected that RCCC will be used by the companies and the institutions involved in the development of $CO_2$ capture materials.

$CO_2$ capture test facilities (absorption, adsorption and membranes) were designed and being constructed to evaluate $CO_2$ capture for exhaust gas, which assumes flue gases from NGCC power plants. In addition, the basic specifications (standard operating conditions, such as temperature, pressure, gas flow rate, dew point etc.) of each unit, and the layout of the facilities were decided. Location and appearance of RCCC is shown in Fig. 1. RCCC is

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located on the RITE site in Kyoto, Japan. Schematics of the test units for absorption, adsorption and membrane is shown in Figs. 2-4. RCCC will start full operation in July, 2025.

As for the standard performance evaluation methods, we have selected the candidate standard materials for $CO_2$ capture evaluation. In addition, the draft of the standard evaluation methods for absorption, adsorption and membranes (gas analysis, the measurement items, evaluation items, format of the evaluation result report etc.) was formulated.

In this presentation, detailed information about the RCCC facilities and some real gas test results of reference materials and using the standard performance evaluation methods will be presented.

RITE is the member of the International Test Center Network (abbreviated ITCN, a global association of facilities around the world that promote research and development of $CO_2$ capture technology), and regularly exchanges information with overseas ITCN members. Therefore, the international collaboration with the ITCN members is expected through the activities of RCCC.

This presentation is based on results obtained from the project, JPNP21024 (FY2022-2024), commissioned by the New Energy and Industrial Technology Development Organization (NEDO).


Fig. 1 Location and appearance of RCCC.

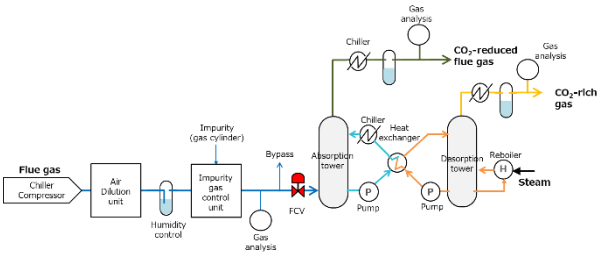


Fig. 2 Schematics of absorption equipment.

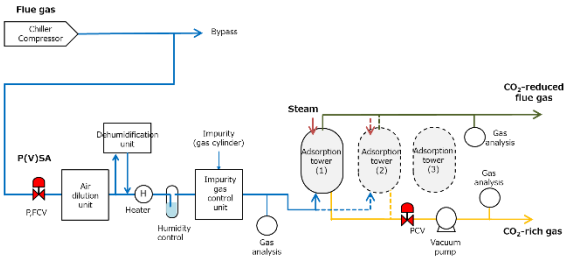


Fig. 3 Schematics of adsorption (PSA) equipment.

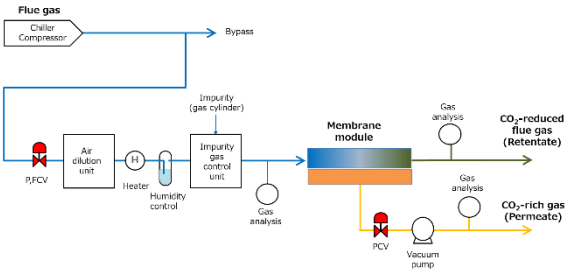


Fig. 4 Schematics of membrane equipment.

*Keywords:* $CO_2$ capture; RITE Carbon Capture Center (RCCC); absorption; adsorption; membrane