

## **Demonstration of tritium extraction from tritiated methane in helium by utilizing plasma decomposition**

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Hydrocarbon is included in exhaust gas from a vacuum vessel of a fusion reactor in which graphite materials are used in a part of plasma facing components. Especially, when a discharge-cleaning using helium or deuterium to aim tritium recovery from the vessel is performed, a considerable amount of hydrocarbon will be released. In the fuel cycle system, tritium has to be extracted from hydrocarbon and reused. In the helium coolant of a high-temperature gas-cooling fission reactor, the removal of tritiated methane from the helium coolant is an important issue from viewpoints of radiation safety for tritium and the corrosion of structural materials. In this study, the experimental system utilizing plasma decomposition and hydrogen permeation was set up and the extraction of tritium from tritiated methane was demonstrated.

A cylindrical plasma chamber of 550 mm in length and 350 mm in inner diameter was prepared for plasma decomposition. The double tube permeator which consists of an inner Pd-Ag pipe and an outer stainless steel pipe was also prepared for tritium extraction. The inlet port of the Pd-Ag pipe was connected to the outlet port of the plasma chamber. A helium gas including H<sub>2</sub>, CH<sub>4</sub>, HT and CH<sub>3</sub>T was introduced into the chamber vacuumed by a scroll pump. During an RF power was supplied to an electrode installed in the chamber, plasma discharge occurs between the electrode and the inner wall. The HTO, HT and CH<sub>3</sub>T released from the outlet of the scroll pump were respectively collected in different water bubblers by using a copper-oxide bed and a catalyst bed. The HT permeating the Pd-Ag pipe was detected by an ionization chamber.

When plasma was generated in the chamber, the current signal of the ionization chamber quickly rose. This indicates that a certain amount of tritium generated by the decomposition of tritiated methane could be extracted by the permeator. The obvious dependence of an RF power on tritium extraction rate was not observed in the range from 20 W to 60 W. However, the extraction rate was raised when the total pressure in the plasma chamber and the permeator was increased.