

§6. Development of Hydrogen Isotope Oxidation Process by Atmospheric Pressure Plasma

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To recovery of tritium released to a radiation control area is one of the major safety issues for tritium handling facilities and future fusion power plants. Oxidation of tritiated hydrogen to water by oxidation reactor is an important process for preventing the diffusion of accidentally released tritium. Several methods have been adopted for recovering tritium, such as a packed type catalytic oxidation reactor, followed by absorption process on a molecular sieve bed and so on. However, these methods have problems for treating a large amount of tritium in low cost and without warm up time and high pressure drop. In order to resolve the issues, we have proposed a hydrogen isotope oxidation process by an atmospheric pressure plasma. This method has the advantages; low pressure drop, without noble metals such as platinum and palladium, control by microwave power etc.

Experimental studies on hydrogen isotope oxidation by an atmospheric pressure plasma generated by 2.45 GHz microwave discharge have been done. As shown in Fig. 1, Argon or nitrogen were used as an operational gas. Small amount of hydrogen and oxygen were mixed in the operational gas during the discharge. The change of the atomic and molecular species ratio was observed by a Quadrupole Mass Spectrometer. Notice that hydrogen was used instead of tritium in this experiment.

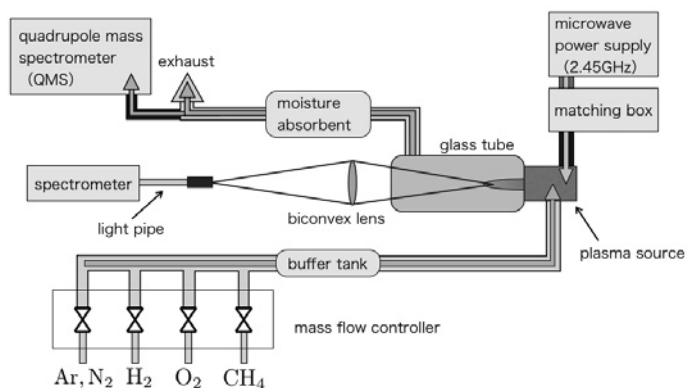


Fig. 1 Experimental setup for hydrogen oxidation using atmospheric pressure microwave discharge.

Figure 2 shows a result of time evolution of main species during a typical experimental sequence with argon plasma discharge. After adding oxygen, relative intensities of hydrogen atom and molecule are decreased. The results indicate that hydrogen oxidation is induced by the atmospheric pressure plasma. The degree of hydrogen oxidation (conversion rate) is increased as increasing the input microwave power (Fig. 3). In addition, it is found that the conversion rate during the nitrogen discharge is higher than that in the argon plasma.

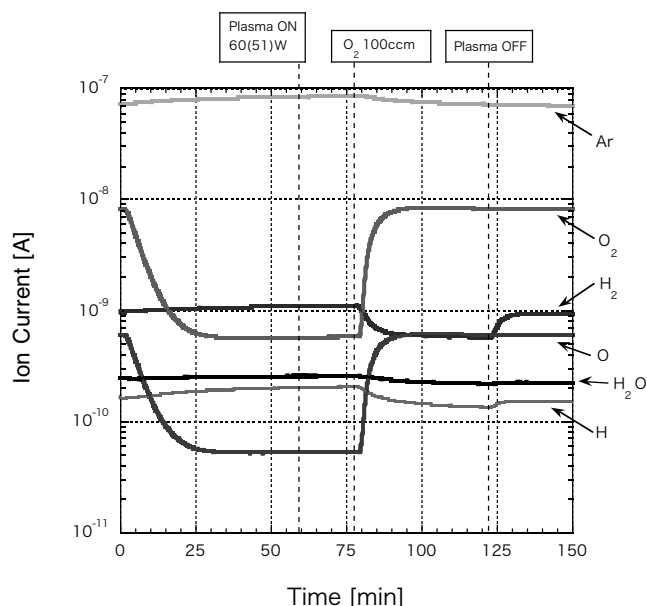


Fig. 2. Change of relative quantity of main species during an experimental sequence with argon plasma.

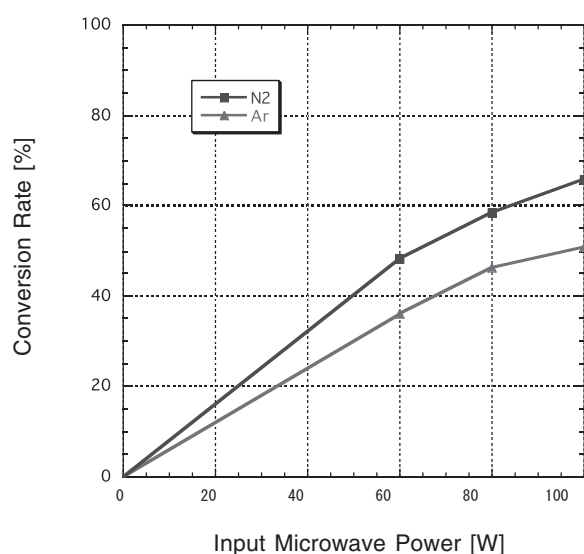


Fig. 3. Dependence of conversion rate on input microwave power for argon and nitrogen plasma.