§9. Tritium Handling

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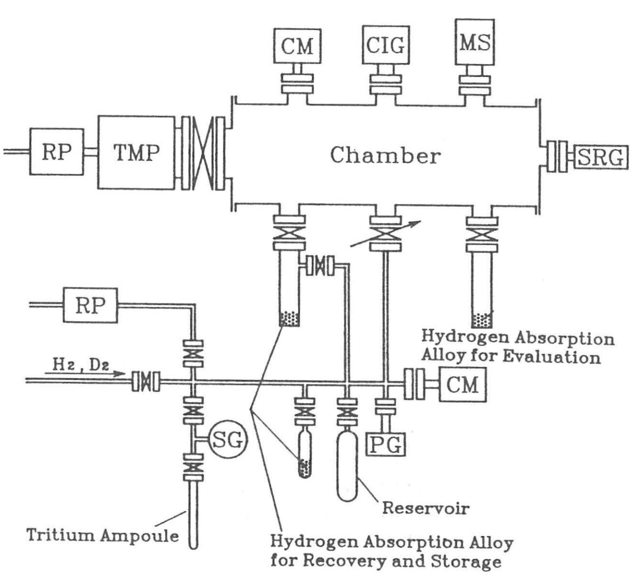
In the fiscal year of 1993, we proceeded the following two subjects in the tritium laboratory.

1. Evaluation of TiCrVFe alloy for Tritium Separation and Storage

In order to separate and store tritium in the nuclear fusion cycle, we tried to use a hydrogen-storage alloy which is safer and is able to be easily handled compared with other materials, especially uranium. The solid solution alloy $TiCr_{0.4}V_{1.2}Fe_{0.4}$ resists pulverization and is easily activated, for these reasons we have chosen the alloy. Using this alloy, we measured the storage volume, the equilibrium pressure and the isotope effect of absorption and desorption reaction in an atmosphere of low hydrogen pressure



RP:Rotary Pump , TMP:Turbo Molecular Pump ,
CIG:Cold Cathode Gauge , SRG:Spinning Rotor Gauge
MS:Mass Spectroscopy , CM:Capacitance Manometer
PG:Pirani Gauge , SG:Strain Gauge

Fig.1 The scheme of the experimental equipment

($10^{-2} \sim 10^2$Pa). Figure 1 shows the scheme of the experimental equipment which was used to examine the alloy. The equipment is composed of three components: a testing system, a gas inlet system and a vacuum system composing a turbo molecular pump (TMP) and a rotary pump (RP). The alloy had an absorbing volume of H/M=0.5 by atomic ratio and the equilibrium absorbing pressure was almost the same as uranium's at the same ambient temperature. The equilibrium reaction has no isotope effect, but the reaction velocity between H_2 and the alloy was two times faster than the velocity between D_2 and the alloy. After 10 repetitions of hydrogen absorption and desorption, we still can not observe any change on the alloy.

2. Evaluation of the W-Value of Various Gases Including ^{3}He and ^{2}H Using Tritium Beta-Ray

W-values of various gases were already reported, but these values are not very accurate and there is almost no report on the value for isotopes. We are developing a new technique aiming at precise determination of W-values of various gases and isotope gases; e.g. ^{3}He, ^{2}H, Ar and Methane. The W-value is mean energy needed to separate a gas molecule into an ion and an electron pair. Then ionization current to be caused by mixed tritium β-ray in each gas is measured by unit liter ionization chamber, and tritium concentration in each gas is also measured by a pair of the same shape proportional counters except their length[1]. According to our preliminary experiments, we are establishing a technique to get precise W-values avoiding the wall effect of the ionization chambers, and uncertainty of the effective volumes of the proportional counters.

1) Abstract of 11th Autumn Conference of the Japan Society of Plasma Science and Nuclear Fusion Research, p116 (1994)