

Application of Tritium Monitor of BIXS Use to Hot Environment

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In case of fusion demo reactor, tritium breeder blanket will be commissioned. Then, the temperature of the blanket sweep gas will be higher than that of ITER test blanket module (TBM). From the viewpoint of tritium management, tritium at high temperature environment may have to be measured. In also the case of ITER-TBM, the measurement of tritium in the sweep gas near the TBM outlet is important to verify the tritium breeding capability. The temperature of the sweep gas near the TBM outlet is also higher than that at tritium extraction system, which is far from the TBM outlet. Therefore, development of tritium gas monitor functioning at hot environment is necessary.

Beta ray induced X-ray spectrometry (BIXS) is one of the applicable methods to tritium gas monitor. It can measure tritium by counting the X-ray that is induced by interaction between the beta ray of tritium and the materials. Tritium gas monitor of BIXS use installed into Tritium Process Laboratory (TPL) in Japan Atomic Energy Agency (JAEA) uses NaI(Tl) as the scintillator. In this work, the NaI scintillator and the photo-multiplier that can work at 150°C have been installed instead of the ordinary scintillator and photo-multiplier. And, the sample gas such as He, T₂, or T₂(1%)-He mixture was introduced into the tritium gas monitor kept at 120°C. Then, the counting rate was observed. The counting rate at 120°C was about a half of that at the room temperature. The counting rate after the heating was almost same with that before the heating. So, the deterioration of the scintillator by the heating has not been observed. This experimental system was closed end type. So, when the pressure of tritium introduced into the monitor is same, the amount of tritium in the monitor at 120°C is smaller than that at the room temperature. This may be one of the causes of the decrease of the counting rate.