§6. Development of Protective Film for Tritium Surface Contamination Measurement

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Introduction Surface contamination of tritium, it is convenient to be measured by using a portable gas-flow proportional counter for tritium measurement (which are referred to as tritium survey meters). Also, two-dimensional distribution of tritium contamination can be visualized by using an imaging plate (IP)[1]. When detecting the contamination of tritium with these instruments, because the range of the β rays from tritium is quite short, probe of the survey meter or IP must be close to the contamination area. These operations will be occurred contamination of the probe or IP, easily. To avoid contamination of these instruments, this study was to create a protective film by using thin films and the plastic frames.

Materials and methods Films were used 1.2μm thickness of polyphenylene sulfide (PPS) film (TORAY INDUSTRIES, INC.). Protective films have been fabricated stuck a PPS film on a frame of plastic rectangle. (Type A for tritium survey meter: outer circumference 23cm × 7cm, inner circumference 21.5cm × 5.5cm. Type B for IP: outer circumference 40cm × 20cm, inner circumference 38.5cm × 18.5cm). Tritium survey meter was used as the TPS-313 (Hitachi, Ltd.). Tritium source were used antique clock faces (unregulated by Japanese law). Comparing the count rate of adhesion measurement by using a protective film with the count rate that directly measurement without the protective film. From the distance of the source to the probe surface at the direct measurements were 1mm or 2 mm. Each of the measurement time were 1 minute.

Fig.1 tritium survey meter (TPS-313: Hitachi, Ltd.)

Fig.2 Protective films (Type A for tritium survey meter)

Fig.3 Antique clock faces (unregulated by Japanese law)

Results In the direct measurement without using a protective film, when the distance of the source and the probe surface is 2 mm, the counting rate was 953 ± 13. The distance of the source and the probe surface of 1mm, count rate was 4203 ± 98.2. Using a protective film, when brought into close contact with the tritium source and the probe surface, the counting rate was 4886 ± 127.5.

Discussion Beta ray from tritium has extremely low energy, maximum range in air of about 5 mm, maximum range in a thin film is about 4 μm. Therefore it is not possible to use commercially widespread thin film made of polyvinylidene chloride (thickness: about 10 μm) as a protective material of the instrument. When performing the direct measurement at a distance of 1 mm to tritium source without using a protective film, closer distance of the source and the probe, there is a risk of contact before and after the measurement. If the probe and the radiation sources are in contact, there is a possibility that the contamination on the sources is attached to the probe.

Conclusion It was create a protective thin film with a frame so that it is easily handling the PPS film of 1.2μm thickness. By using the protective film and tritium survey meter, it was possible to low risk of contamination measurement with a high detection efficiency.

1) Takuya, S., *Tracer*, 37, 6-8 (2005)