## §46. Tritium Measurement from Dust Particles using Liquid Scintillography

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An investigation of retained tritium in plasma facing materials is important issues in ITER and DEMO. Reports of tritium and hydrogen isotope measurements in small dust particles collected in medium/large tokamaks are limited, and particularly quantitative measurement is required to extrapolate their data to the fusion reactor. Liquid scintillography counting (LSC) was applied to the quantitative analysis of tritium in a small amount of dust, and one of technical issues for LSC measurement, such as a selection of a cocktail and a wipe material, was investigated in this collaboration work. Experimental results of a solubility efficiency were reported.

In JET-ILW (ITER like wall), dust particles were collected in 2012, just after the first operation period. A typical size of ILW dust particles was from 0.1 to 100 microns and collected amounts were a little about 1 gram. For these particles, many kinds of analyses were planned, such as surface morphologies, compositions, nano-scale structures, amounts of hydrogen / deuterium / tritium, so on. Many dust particles were sticking at the inner surfaces of the glass bottles by the static charge. For the LSC analysis, we collected dust particles by wiping the inner surface of the sample bottles by different wiping materials. If the wipe material is remained in cocktails, a counting of liquid scintillography decreases due to absorption of beta-ray.

Some combinations between a cocktail, which was made by PerkinElmer Corporation, and a material can be melting and the results were reported [1]. Hence, we selected five materials for a wiping off of dust particles in sample bottles. These materials are listed in Table 1 and a picture is shown in Fig.1.

Important points of solubilization are a solubility and a transparency of mixed cocktail. Solubility efficiencies were evaluated and three levels are shown such as follow ; 1) A material was fully melted in level 1 (○), which is not observed in this experiment, 2) a material was roughly melted and a cocktail was almost clear in level 2 (△), 3) a material was remained and was not melted in a level 3 (×). Finally, a polycarbonate type membrane filter was selected by the results of solubility efficiency in cocktail and unbreakable material during the wiping work (workability).

Using polycarbonate membrane filters, ILW dust particles stored in glass bottles were caught out and put on Hionic-Fluor cocktail with Soluene-350, which is toluene base solution. Using this method, quantitative analysis of tritium measurement was successfully done for ILW dust particles. This work was supported by the NIFS budgets KEMF078 and the Broad Approach collaboration in JAEA.

[1] J. Thompson, D.A. Burns, “LSC Sample Preparation by Solubilization”, Report in PerkinElmer Corp., (2014)

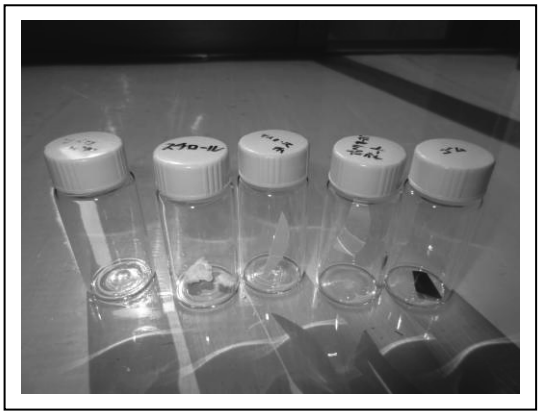

*Fig. 1 Pictures of bottles with materials before a cocktail installation. Bottles are numbered 1 to 5 from the right side.*

Table 1: Solubility efficiency for different materials. Pictures of these bottles are shown in Fig.1

| Bottle No. | Materials | Solubility efficiency | Workability |
|---|---|---|---|
| 1 | nitrile butadiene rubber | × | ○ |
| 2 | Polycarbonate Type Membrane Filters | △ | ○ |
| 3 | Mixed Cellulose Ester Type menbrane | × | ○ |
| 4 | polystyrene | △ | × |
| 5 | Silica Aerogel | △ | × |