# The Applicability of Core Sampling to Treatment of ITER Type B Radwaste


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## 1. Introduction

Type B radwaste (intermediate level and long lived radioactive waste) generated from the vacuum vessel of the ITER Tokamak building are to be treated and stored in the hot cell building. Sampling is the one of treatment processes, which is used to obtain small pieces of samples from metallic Type B radwaste components in order to evaluate the tritium content. In addition, sampling has to be carried out without the use of any liquid coolant to avoid the spread of contamination. In this study, core sampling is suggested as one of the sampling techniques.

## 2. Core sampling

Core sampling is applied to take core samples from materials using a broach cutter (Fig. 1) as a core drill bit under dry conditions. During the core sampling, compressed air is supplied continuously to reduce the drilling temperature of the drill bit and workpiece, and remove the cutting chips, which damage on the drill bit.

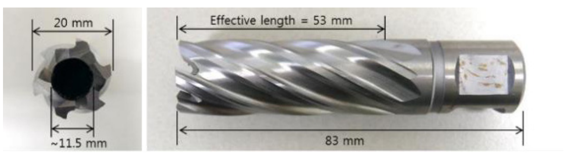


Fig. 1. Core drill bit used in core sampling.

## 3. Experiment

### 3.1 Sampling

Core sampling experiments for SS316L and CuCrZr materials, both of which have a 50 mm thickness, were conducted. Experimental conditions are presented in Table 1, and obtained SS316L and CuCrZr core samples of 50 mm in length are shown in Fig. 2.

Table 1. Sampling conditions of core sampling

| | SS316L | CuCrZr |
|---|---|---|
| Spindle speed (rpm) | 150 | 150 |
| Feed rate (mm/min) | 5 | 5 |
| Traverse speed (mm/min) | 150 | 150 |
| Depth of cut (mm) | 0.5 | 1.0 |

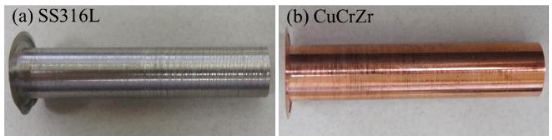


Fig. 2. Core sample: (a) SS316L (b) CuCrZr.

### 3.2 Measurement of Temperature Variation

The goal of sampling is to take samples without tritium loss. Because tritium release is generally affected by temperature, it is essential to know the temperature distribution into the core sample and the cutting zone during the sampling process. To measure the temperature of the core sample, a K-type thermocouple was used. Based on the fact that tritium is concentrated near the surface of Type B radwaste, a thermocouple was embedded 5 mm below the surface at the center of the core sample. Experiments were performed to a depth of 30 mm, and the temperature values were recorded in real time. Fig. 3 shows the measured core center temperature for SS316L and CuCrZr. The maximum temperatures were 44.5 ºC and 32.8 ºC (initial temperature=25 ºC), respectively.

The temperature distribution in the cutting zone was recorded by infrared (IR) camera during core sampling. Fig. 4 shows the analysis results of IR images captured at the beginning of the sampling. The maximum temperatures were 76.1 ºC for SS316L and 14.5 ºC for CuCrZr, which increased approximately 73 ºC and 12 ºC compared with initial temperature, respectively.

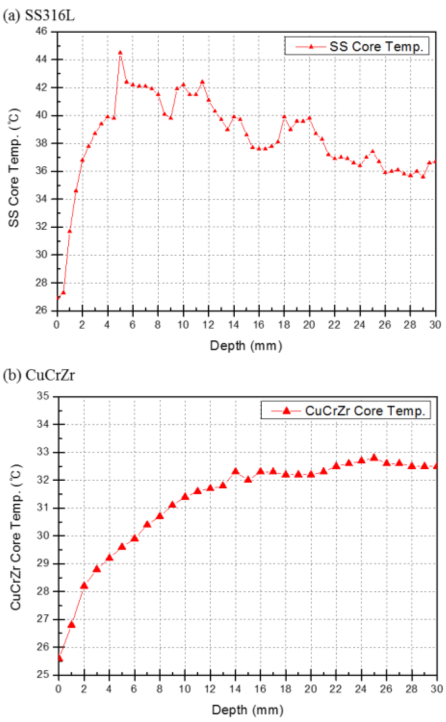


Fig. 3. Temperature variation measured at the center of core sample during drilling for (a) SS316L and (b) CuCrZr.

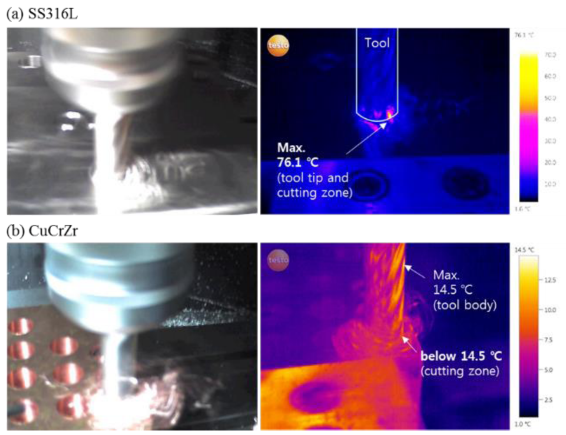


Fig. 4. Cutting zone temperature (a) SS316L and (b) CuCrZr.

## 4. Conclusion

Core sampling, which is a candidate sampling technique to be applied to the ITER hot cell, is available for thin (less than 50 mm) metallic Type B radwaste, SS316L and CuCrZr, without the use of a coolant. According to the results of a temperature measurement, it can be stated that the temperature of the core sample and cutting zone for SS316L and CuCrZr will be below 100 ºC during the core sampling under the applied conditions. These cutting temperatures are considered to be much lower than the tritium releasing temperature of Type B radwaste. Thus, it can be affirmed that heat generation during core sampling will have no significant effect on the tritium release.

## REFERENCES


[1] D. Torcy et. al. “Technical specification of Type B radwaste processing and treatment equipment development”, EGVZ3J(ITER Document), 08 Jul. 2015.