

Chemical Decontamination with Ultrasonic of Dismantled Metal Waste

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Korea Atomic Energy Research Institute (KAERI) started a decommissioning program of the uranium conversion plant. In 2004, pre-work was performed as follows: repair of electrical power supply system, inspection and repair of fire alarm and fighting system, installation of ventilation system, radiation management and access control facility, inspection and load testing of crane, distribution and packaging of existing waste, and pre-decontamination of the equipment surface and interior. Dismantling started first from the reuse area such as temporary waste storage and the decontamination and lagoon sludge treatment. And then, we dismantle in the order of the most remote room from the waste treatment area. Order of dismantling work is as follows: disconnecting of pipe and electric wire, separation of the equipment, cutting into small pieces, grouping of the dismantled pieces for decontamination or packing, decontamination of floor and wall, and measurement of remained contaminants. Now, dismantling was completed of 25 rooms in the 27 rooms. The rest 2 rooms are ventilation and spare parts storage rooms. Dismantled metal wastes are 179 ton and stainless steel wastes are 73 ton. These are cut into small pieces by cutting equipment such as nibbler, band saw, wheel saw, and plasma cutter to decontaminate. This paper introduced chemical decontamination with ultrasonic of stainless steel waste.

Samples were taken from tanks and pipes as a property of uranium conversion process. The chemical composition of uranium was uranium dioxide, ammonium uranyl carbonate (AUC), and uranyl nitrate hexahydrate (UNH) as the process. The plate samples were cut by using a nibbler as a size of 20 by 20 cm and the pipes were cut by a pipe cutter as a size of 20 cm. Experimental equipment consists of decontamination tanks and ultrasonic generator. The tank size is 500 L. 10 wt% of nitric acid was used as a decontamination chemical and was circulated in the tank through a filtration system. Decontamination was performed at 50 °C with time and samples were rinsed out with steam after chemical decontamination. Contamination was analyzed by a MCA with HPGe detector (Canberra).

Dismantled metal waste is contaminated with uranyl nitrate, ammonium uranyl carbonate, and uranium oxides. The plates contaminated with UNH or AUC can be decontaminated less than conditional release criteria, 0.2 Bq/g of alpha in 10 minutes. It is estimated that the plate contaminated with UNH or AUC can be decontaminated easily. The plate contaminated with uranium dioxide can be decontaminated less than 0.2 Bq/g of alpha in 60 minutes. Uranium dioxide doesn't dissolve easily in a low concentration nitric acid. So, it is estimated that the decontamination of plate contaminated with uranium dioxide need a time over 60 minutes. Pipe was decontaminated as plate and it will be expected that decontamination agent didn't circulate inside the pipe. So, contamination after decontamination was measured after cutting in half the pipe. The pipe contaminated with AUC can be decontaminated less than 0.2 Bq/g of alpha in 30 minutes. It is confirmed that the pipe also can be easily decontaminated as the plate.

However, most dismantled stainless steel waste was not decontaminated in short time of 10 minute or 30 minute. Some dismantled waste such as waste storage tank took 1 hour to decontaminate less

than 0.2 Bq/g. Figure 1 shows SEM picture of metal surface before and after decontamination. Radioactivity of metal waste after decontamination in 10 minute and 30 minute (total 40 minute) is 1.59 Bq/g and 0.21 Bq/g, respectively. It could be confirmed that contaminant exist on the metal surface as shown figure (b) and (c). Radioactivity of third decontamination (total 70 minute) is 0.12 Bq/g.

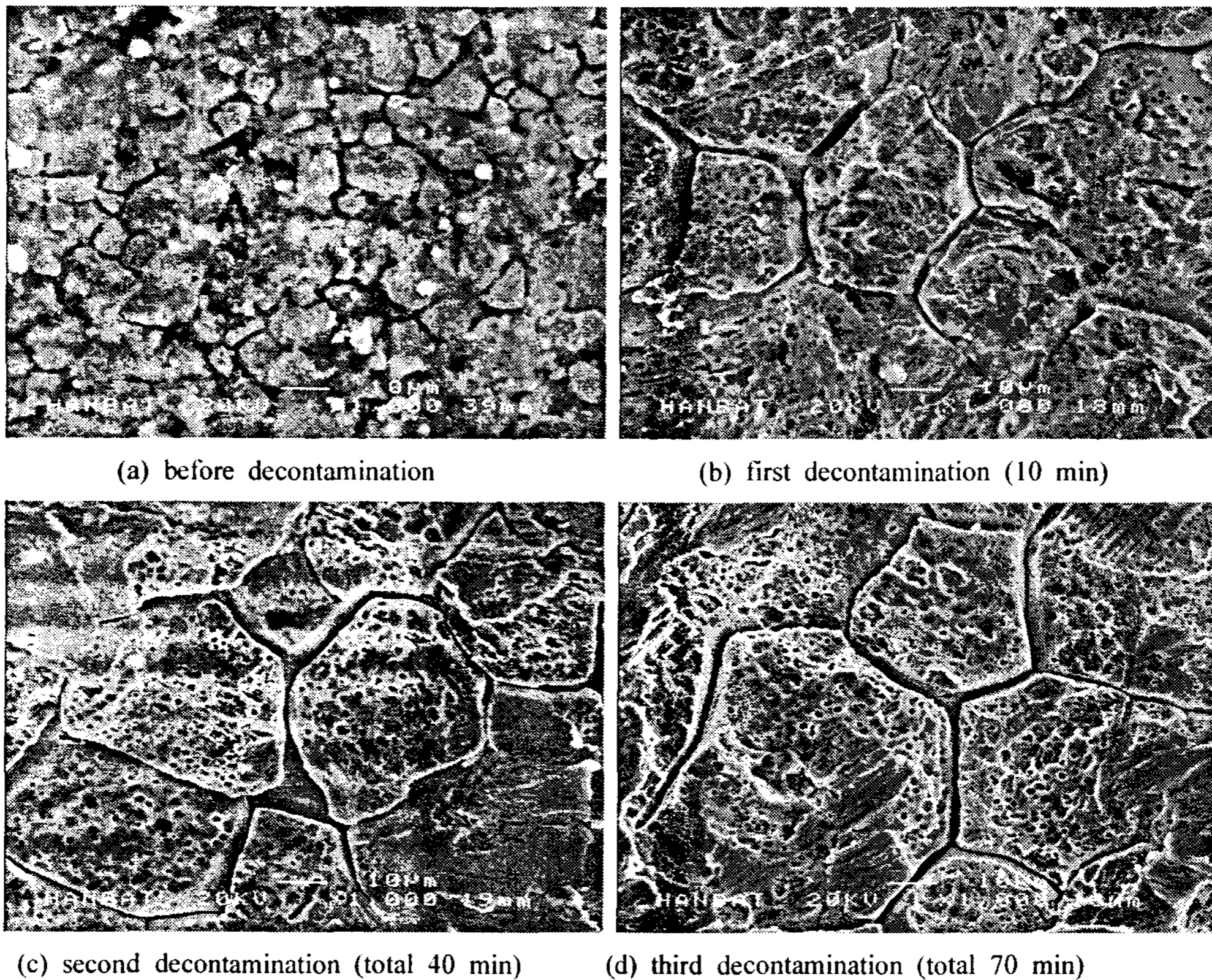


Figure 1. SEM picture of metal surface before and after decontamination

Table 1 is a result of the first decontamination for 1 week (5 batch/day) regardless of contamination characteristics as decontamination time. Therefore, stainless steel wastes can be decontaminate over 85 % with first decontamination in 1 hour and these are being decontaminated in this condition now.

Table 1. Pass-rate with first decontamination as decontamination time

Decontamination time	Pass-rate with 1st decontamination
10 minute	66 %
30 minute	68 %
60 minute	85 %