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Decontamination tests of dust under load for the ITER blanket remote handling system

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Radioactive dust will accumulate in the vacuum vessel (VV) of ITER after plasma operations. Thus, the ITER Blanket Remote Handling System (BRHS) will be installed in the VV to handle the blanket modules, which can weigh up to 4.5 ton and be larger than 1.5 m, stably and with a high degree of positioning accuracy. The BRHS itself also needs to undergo regular maintenance in the Hot Cell Facility (HCF). Maintenance workers will be exposed to the radioactive dust that adheres to the surface of the BRHS. Past studies estimated the contaminated surface area of the BRHS, however, in this study, decontamination tests were performed and the dose rate to maintenance workers was calculated using the Monte Carlo N-Particle Transport Code (MCNP5). Decontamination tests were performed by using multiple test pieces of varying surface roughness (Ra 12.5, Ra 6.3, and Ra 1.6) made from SUS329J4L and two different types of brushes to simulate decontamination of the BRHS surface. Tungsten dust was pressed on the test pieces to simulate the loading by the rollers. After the test pieces were brushed the surface of each test piece was observed by using both optical and scanning electron microscopes. Dust was reduced by approximately 99% in all cases where the SUS304 brush was used regardless of surface roughness. Afterwards, the decontamination rate (amount of dust that was cleaned) was used to estimate how much dust will be able to be cleaned from the BRHS surface. This paper describes the optimal decontamination tools with respect to the BRHS surface conditions to calculate and hopefully reduce the dose rate to maintenance workers so as to optimize the BRHS maintenance plan in the HCF.

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