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Experimental simulation and technological solution for DEMO dust de-tritiation

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Significant production of radioactive metal dust, mainly due to erosion of plasma facing components, is expected to be present in the vacuum vessel of DEMO while it is operating. A relevant tritium content is expected to be present in this dust. Therefore, the removal of tritium and the management of this radioactive dust for safety reasons and for eventual remanufacturing or appropriate disposal are key issues.
Today several techniques are available for producing pure tungsten components, or mixtures of tungsten and other metallic and non-metallic materials. Basically, the tungsten powder metallurgy follows the sequence Mixing, Pressing and Sintering. These techniques could be used to the re-fabrication or the safely appropriate disposal of tungsten eroded dust.
The present work describes the study to select and optimise techniques for the detritiation of the DEMO W dust, able to produce massive, mechanically stable components to be further processed for disposal or possible recycling. These selected strategies and techniques are aimed at decreasing the presence of mobilisable tritium on site during operation and reducing the quantities and/or classification levels of radioactive waste. The development of technological solutions and the design of the operating conditions to facilitate the next handling and destination of the materials toward disposal, recycling or re-fabrication avoiding any problem of radioactive dust dispersion have been studied.
RINA Consulting CSM has done during 2021 experimental activities for Tungsten powders hydrogenation starting by ultra-pure commercial powders with an average granulometry of 20 □m. The 2022 sintering tests with Tungsten "polluted"powders to simulate exogenous species present in the DEMO W dust are described, to evaluate the feasibility of sintering and de-hydrogenation. Results will be discussed in the paper.

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