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#3-228 Activation of the inner irradiation Snail after long-term operation of the KATANA irradiation facility

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The KATANA irradiation facility was commissioned at the Jožef Stefan Institute in early 2024 with the aim of investigating water activation in fusion reactors such as the International Thermonuclear Experimental Reactor (ITER) and the Demonstration Power Plant (DEMO). It is a closed-water activation loop designed to perform benchmark experiments to validate the newly developed fluid activation computer codes using the TRIGA Mark II research reactor at the Jožef Stefan Institute (JSI TRIGA). The KATANA water circuit consists of a pipe loop that is partially inserted into one of the horizontal irradiation channels, namely the radial piercing port (RPP), of the JSI TRIGA reactor. The inner part of KATANA consists of three components: the inner irradiation part, namely "irradiation Snail", which it is in close proximity to the reactor core where most of the water activation process occurs, and the corresponding gamma & neutron shielding plugs behind it. Since the RPP also penetrates the concrete bioshield of the reactor and thus practically touches the reactor core, the inner part of the KATANA is exposed to the high neutron flux, resulting in the neutron activation of the material. To minimise neutron activation, aluminium was chosen as the main material for the inner Snail (and also for other tubes) instead of stainless steel, even though this led to greater difficulties in construction. The aim of this work is to assess the long-term neutron activation of the inner part of the KATANA facility, especially the inner irradiation Snail, which will be the most problematic part in terms of the highest activation achieved. At the end of 2025, the existing inner Snail is planned to be replaced by a new ITER-relevant irradiation head designed to address conditions that are more relevant to ITER. Prior to this, a comprehensive neutron activation analysis of the existing inner part of KATANA is required to support the licencing process. The aim is to determine the waiting time for safe maintenance of the inner part of KATANA after 2 years of irradiation (reactor TRIGA operation) in order to ensure to minimise radiation doses for personnel (dealing with the activated material) and reduce radiation damage to the equipment. The final goal of this research is to calculate the activation of the inner Snail and dose rate over time after irradiation to determine when the inner Snail can safely be exchanged. The obtained results are also viable for decommissioning assessment. The activation calculations are performed with an already developed KATANA model, specifically the inner Snail model, using the neutron transport code MCNP based on the Monte Carlo method, and the isotopic activation and transmutation code FISPACT-II. The results of this analysis will be of crucial importance and will provide essential guidelines for future activities. In addition, the obtained results will be crucial in the decommissioning phase, when the radioactive components will have to be removed and stored appropriately.

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