MCNPX Simulation of Proton-Irradiated Construction Steels for Nuclear Installations

Katarína Sedlačková [a)], Branislav Stríbrnský and Vladimír Nečas

Slovak University of Technology in Bratislava, Institute of Nuclear and Physical Engineering, Ilkovičova 3, 812 19 Bratislava, Slovakia

[a)] Corresponding author: katarina.sedlackova@stuba.sk

Abstract. Simulation of 5 MeV-proton irradiation of different construction steels for nuclear installations was performed using the MCNPX code to support proton irradiation experiments aimed at studying accelerated radiation aging. The main goal of the simulations was to predict an induced activity of the studied samples during implantation experiments. The materials investigated were different types of Fe-Cr-based construction steels comprising ferritic/martensitic steels and its oxide dispersion strengthened variant. The paper presents calculation details specific for a couple of MeV-protons simulations comprising the information on the proton nuclear data and the physics models' usage in the MCNPX code. The reaction rates and the energy deposition were calculated to quantify the main interaction mechanisms, whereby the capability of the MCNPX code to track the secondary particles was used. Physics models were employed to determine the nuclides inventory produced during irradiation. The induced mass activity was calculated from the number of radioactive residuals and reached values between 15 and 67 kBq/g immediately after irradiation. The results from simulations will be compared with the activity of the samples determined by gamma spectroscopy measurements in our next paper.