Measurement and Simulation of Induced Radioactivity in Permanent Magnets

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Abstract

To avoid unjustified exposure of personnel and environment, the induced radioactivity in permanent magnet of syncrotron radiation light source, has been studied. At the same time,the investigation on the activation of permanent magnet is a new approach to analyze the demagnetization mechanism of these magnets, which is an important issue of the insertion device of syncrotron radiation light sources.

The activation of the permanent magnet is investigated with both Monte Carlo simulation and experiment. The yields of possible remanent nuclides in the magnet due to 2 GeV electrons and secondary particles are estimated with Monte Carlo code FLUKA(2005 version). Considering the exempt level of all these nuclides, the dose level at 1m distance due to these activated nuclides is derived. The decrease of the dose rate with time after irradiation is also calculated according to the half life time of the activated nuclides. Targets made of different materials (Cu,Ta) are used to generate different radiation fileds. The activation levels under three conditions(Cu target,Ta target,no target) are compared and analysed. It shows that in Cu target case the activation is highest.

In the experiment, the samples($Nd_2Fe_{14}B$,Sm_2Co_{17}) are irradiated by 2 GeV electrons of Pohang Accelerator light source. The samples are unmagnetized and the size is 10mmx10mmx4mm. The activated samples are measured and analysed with HPGe detector. FLUKA simulation is uesd to get the exact efficiency of HPGe.

After the comparsion of the results of calculation and measruements, with the knowledge of the character of the radiation field , the possible important interaction between the primary or secondary particles and nuclides are summarized. Considering the demagnetizaion of the magnets in diffrent radiation fileds, the relation of the activation and demagnetization is analysed.