Radiation Effects in IFMIF Li Target Diagnostic Systems

J. Molla\textsuperscript{a}, R. Vila\textsuperscript{a}, T. Shikama\textsuperscript{b}, H. Horiike\textsuperscript{c}, S.P. Simakov\textsuperscript{d}, M. Ciotti\textsuperscript{e} and A. Ibarra\textsuperscript{a}

\textsuperscript{a}CIEMAT-Centro de Investigaciones Energeticas Mediioambientales y Tecnologicas, Association Euratom-CIEMAT, Avda. Complutense, 22, E-28040 MADRID, Spain

\textsuperscript{b}Inst. for Materials Research, Tohoku University, Katahira 2-1-1, Aoba-ku, 980-8577 Sendai, Japan

\textsuperscript{c}Osaka University, 2-1 Yamada-oka, Suita City, 5650871 Osaka, Japan

\textsuperscript{d}Forschungszentrum Karlsruhe, Zimer 203, Gebaeude 451, Abteilung HVT-TL, Postfach 3640, D-76021 Karlsruhe, Germany

\textsuperscript{e}ENEA CR Frascati, Via Enrico Fermi 40, 00044 Frascati (Roma), Italy

Construction of IFMIF is planned to start in 6-8 years, following the Engineering Validation and Engineering Design Activity phase (EVEDA). The detailed engineering design of all the systems required for IFMIF and the test of system prototypes will be performed during this phase.

One of the main systems will be the liquid lithium target. Two high energy deuteron beams will impact on a 20x5 cm\textsuperscript{2} area producing an intense neutron flux of about $10^{18}$ n/m\textsuperscript{2}/s. The Li target is therefore the intersection of two sophisticated systems: the high energy deuteron beams and the Lithium loop. Several key parameters from the Li target must be controlled during the operation of IFMIF. The control of these parameters is important, not only for the operational of IFMIF itself, but also from the safety and licensing point of view.

The Li temperature distribution on the target surface, the presence of surface waves and their amplitude, the pressure or the good performance of the back plate (behind the Li target and exposed at the maximum radiation flux) must be measured by some diagnostic systems that will be exposed to high radiation fields and/or some Li-atoms bombardment. Any of the proposed diagnostic systems may suffer intense radiation damage in some critical points as lenses, mirrors, metallic probes, etc. There are several known radiation effects, as swelling, optical absorption increase and radioluminescence in optical fibers or windows, change of refraction index in optical lenses, electrical degradation, etc, that may seriously affect the properties of materials or components giving rise to a malfunctioning of the whole diagnostic system. The experience during the research on the radiation effects on materials with applications in ITER produced a lot of information that may now be used for the assessment of radiation effects on Li-target diagnostic systems.

The aim of this paper is the revision of some of the proposed diagnostic system, the estimation of the radiation dose rate in the most critical points of them, and the discussion of their performance taking into account the potential radiation effects together the experience developed during the last few years for ITER.

Number of words in abstract: 348

Keywords:
Technical area: A1. Irradiation facilities (fission, spallation, IFMIF, charged particles) and innovation
Special session: Not specified
Presentation: No preference
Special equipment: No special equipment