Activation simulations for EU DEMO limiter components

E. Laszynska[1], B. Bienkowska[1], D. de Macedo[1], J. Wlodarczyk[1], T. Berry[2], J. Elbez-Uzan[3]

[1] *Institute of Plasma Physics and Laser Microfusion, Hery Street 23, 01-497 Warsaw, Poland*

[2] *United Kingdom Atomic Energy Authority, Culham Science Centre, Abingdon, Oxon, OX14 3DB, UK*

[3] *EUROFUSION Programme Management Unit, Fusion Technology Department—DEMO Central Team, Boltzmannstrasse 2, 85748 Garching, Germany;*

The activation simulations play a key role in designing future fusion power plants. They allow for predicting the time evolution in chemical composition, activation, decay heat, and dose rate for materials to be used in a fusion reactor like the European DEMO. The simulations' results provide valuable input for shielding design, preparing the maintenance schedules as well as waste disposal planning for long-term activated materials.

The activation calculations consisting of neutron and photon nuclear heating, decay heat, alpha decay heat, dose rate, ingestion dose rate, inhalation dose rate, activity, and dominant nuclides assessment have been performed for the components of the Outboard Equatorial Limiter (OEL), the Upper Port Limiter (UPL), the Outboard Lower Limiter (OLL) and the Inboard Midplane Limiter (IML) for the DEMO fusion reactor. Two different breeding blanket concepts have been considered: Helium Cooled Pebble Bed (HCPB) and Water Cooled Lithium Lead (WCLL).

At the preliminary stage of the study, the CAD limiters models have been integrated with the neutronic DEMO model, and then the neutron transport calculations for each limiters component have been performed using the MCNP code. The MCNP-calculated neutron spectra for all limiter components were used to run activation simulations using the FISPACT-II inventory code for the assumed irradiation scenario for DEMO. The results of activation simulations for OEL, UPL, OLL and IML will be presented and discussed.

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