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Development of the calorimeter for low nuclear heating rates for the MARIA Research Reactor

The MARIA Research reactor is a neutron source for irradiation of target materials for medicine and industry: radioisotope production, Mo-99 production, neutron modification of silicon doping and minerals, Recently it regains its scientific meaning as the capabilities to design and implement irradiation rigs had been regained. In the last few years four instrumented thermostatic rigs were irradiated. Currently, there i san ongoing development of the dedicated rig for ITER diagnostic windows and discs. Crucial preparatory step is the measurement of nuclear heating in the designated irradiation channels. The problematic issue in those channels nuclear heating estimation as it has significant uncertainties. So far, the nuclear heating was estimated based on the TLD detectors irradiation and alanine detectors irradiation within one entire reactor cycle and after cool-down period the Energy deposited in the detectors was measured. Taking into account the short cycles of the MARIA Research Reactors and constantly changing core arrangement this method is far from ideal. To speed up the measurements and reduce the measurement uncertainties the calorimeter has been developed. Based on the nuclear heating measurement data the actual irradiation rigs for various samples of ITER diagnostic windows is under development. The goal of the PhD Thesis is to thermally optimize the vehicle design to meet both programatic and safety requirements of the project. The scope of the project is to gather the data which enable the informed choice of ITER diagnostic windows in the ITER facility.

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