THE STUDY ON THE EFFECT OF PULSED PLASMA LOADS ON BERYLLIUM DAMAGE [[1]](#footnote-1)\*)

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The first wall panels of the ITER main chamber will be completely armored with beryllium. The primary reasons for the selection of beryllium as armor are its low Z, high oxygen gettering characteristics and also high thermal conductivity. During plasma operation in the ITER, beryllium besides low cyclic heat loads (normal events) will be suffered by high transient heat loads, such as ELMs, disruptions, VDE, etc. (off normal events). These transient pulse loads cause rapid heating of beryllium surface and can result in significant changes in surface and near-surface regions, such as material loss, melting, cracking, evaporation and formation of beryllium dust as well as hydrogen isotopes retention both in the armor and in the dust. In experiments on modeling the behavior of beryllium in ITER, it is also necessary to take into account the magnetic field affecting on the material when it is irradiated by plasma flows in ITER.

This article presents the results of experiments carried out at JSC VNIINM at the QSPA-Be facility aimed to study the surface damage of beryllium heat-shielding cladding samples when irradiated with pulsed deuterium plasma flows simulating the effects of ELM plasma events in ITER. The QSPU-Be facility represents a single-stage coaxial quasi-stationary plasma accelerator. It is capable to provide plasma (hydrogen or deuterium) and radiative thermal loads on target surface, simulating ELM, plasma disruptions, and mitigated disruptions expected in ITER. The beryllium mock-ups of a special design were tested in deuterium plasma flows (6 cm in diameter) with pulse duration of 0.3 ms at a thermal load of 0.6 MJ/m2 for up to 20 shots. The angle between the plasma flow and the mock-up surface was 45° and 90°. The magnetic field induction (B) at the surface of mock-ups was 0.6 T. In all experiments, the plasma flow moved along the magnetic field. Two grades of beryllium approved for use in ITER were studied in the experiments: TGP-56PS (RF, JSC VNIINM) and S-65C (USA, Materion Brush). New data are presented on the effect of a 0.6 T magnetic field on erosion and surface damage of beryllium at a thermal load of 0.6 MJ/m2. The experimental data obtained are used for the verification of the corresponding numerical models and for the estimation of lifetime of the beryllium cladding.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/E/ru/KA-Kupriyanov.docx) [↑](#footnote-ref-1)