ICFRM2007/35
Influence of radiation damage on plasma-facing material erosion

V.S. Koidan\textsuperscript{a}, A.N. Bruchanov\textsuperscript{b}, O.K. Chugunov\textsuperscript{b}, V.M. Gureev\textsuperscript{b}, B.I. Khripunov\textsuperscript{b}, S.N. Kornienko\textsuperscript{b}, B.V. Kuteev\textsuperscript{b}, S.T. Latushkin\textsuperscript{b}, A.M. Muksunov\textsuperscript{b}, V.B. Petrov\textsuperscript{b}, A. Ryazanov\textsuperscript{b}, V.P. Smirnov\textsuperscript{b}, V.G. Stolyarova\textsuperscript{a} and V.N. Unezhev\textsuperscript{b}

\textsuperscript{a}Russian Science Center “Kurchatov Institute”, Ploshchad’Akademika Kurchatova 46, 123181 Moscow, Russian Federation
\textsuperscript{b}Russian Science Center, Ploshchad’Akademika Kurchatova 46, 123181 Moscow, Russian Federation

koidan@nfi.kiae.ru

Selection of structural materials for a fusion reactor is a very actual problem. Plasma-facing materials (PFM’s) of the first wall and divertor of the fusion reactor will be affected by high heat, fast particle fluxes and 14 MeV neutron irradiation. All these factors are crucial for the lifetime of the fusion reactor components. Fast neutrons produce a high-level of radiation damage (estimated value is up to hundred dpa) in materials during long operation of fusion reactor. At the same time, PFM’s will suffer erosion induced by the plasma as well. While important data on the plasma erosion have been collected for non-irradiated materials, it is difficult to qualify PFM’s at present taking into account radiation damage effects.

In this paper, we present the first experimental results on radiation-damage effects on erosion of materials under plasma impact. To obtain high level of radiation damage we simulate neutron irradiation by fast ions on the Cyclotron at Kurchatov Institute providing energies of 1-30 MeV. Using this method we can obtain the radiation damage equivalent in a few days that corresponds to fast neutron dose of irradiation \( \sim 10^{26} \) neutron/m\( ^2 \). Carbon materials were taken for the study as the targets: pyrolytic graphite (reference), MPG-8 (Russian graphite) and CFC SEP NB (ITER PFM candidate). Irradiation of these materials on the cyclotron has been performed with 5 MeV carbon ions. Plasma erosion was studied on the linear plasma simulator LENTA. Irradiated samples were exposed to steady-state deuterium plasma at 100 eV (D\textsuperscript{+} ions) to dose \( \sim 10^{25} \) ion/m\( ^2 \). The microstructure modification was observed and comparison was made on damaged and non-irradiated materials. The experiments have been performed with 1-10 dpa of radiation damage. The results of the work appear to be an important step in further detailed characterization of PFM’s in fusion reactor.