# HYDROGEN PERMEABILITY OF BERYLLIUM FILMS PREPARED BY THERMIONIC VACUUM ARC METHOD

Vincenc Nemanič[1], Bojan Zajec[1], Marko Žumer[1], C. Porosnicu[2], C.P. Lungu[2]

[1] *"Jožef Stefan" Institute, Jamova 39, 1000 Ljubljana, Slovenia*
[2] *National Institute for Lasers, Plasma and Radiation Physics, NILPRP, Magurele-Bucharest 077125, Romania*

*Corresponding author: vincenc.nemanic@ijs.si*

Beryllium films will be applied in fusion reactors as one of the main components (Be, W, CFC) of the first wall in the near future [1]. The morphology, adhesion and thermal stability of thin films deposited by the thermionic vacuum arc (TVA) method have been confirmed to be compatible with these extremely high demands [1, 2]. The role of Be in tritium retention and release may be well predicted assuming that low solubility of hydrogen in Be suppresses migration of the fuel into the tiles. Actual Be films used in the future experiments may contain voids or channels causing unwanted porosity which may change the tritium interaction kinetics with the coated tiles.

In this paper, we present results of precise hydrogen permeation measurements through 8 micrometer thick Be films deposited by TVA. Substrates were 0.5 mm thick 40 mm diameter discs of Eurofer steel having the geometric area exposed to hydrogen of 8.4 $cm^2$. The permeation reduction factor (PRF) of Be coated membranes at 400 °C and upstream hydrogen pressure of 1 bar varied on 5 samples roughly from 10 to 1000 compared to the uncoated Eurofer membrane. At barriers having low PRF, fast transients of the observed permeation flux which followed the upstream pressure change supports the picture that Be films are porous on the micro-scale or nano-scale. The size or distribution of the leak channels that would support the observed behaviour could be predicted by theoretical models. Inter-granular micro-channels were indeed revealed on low-angle cross sections of the Be films by SEM, but their number and total area do not fit well the models. The PRF of a particular membrane could be additionally modified when the Be films were intentionally oxidized. The subsequent XPS analysis shows that a thin BeO layer is grown on the Be surface, but it should always increase the PRF. The process responsible for permeation flux change is presumably the oxidation of the Eurofer membrane inside the Be micro-channels.

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