

PERMEATION TESTING OF MATERIALS SUITABLE FOR FUSION REACTORS

P.S. Korinko, T. M. Adams, E.A. Clark, and R.L Sindelar
Savannah River National Laboratory, Aiken, SC 29808, U.S.A.
paul.korinko@srnl.doe.gov

Tritium permeation has been identified as a significant technical and environmental challenge for ITER. The large surface area of the thin wall heat exchanger, the high tritium partial pressure, and the high exposure temperature combined with a low allowable tritium loss all enhance the importance of reducing tritium permeation. Programs at the Savannah River Site have recently developed and tested permeation resistant coatings and materials. These materials include overlay coatings applied by a novel method, similar to electron beam physical vapor deposition (EB-PVD), in which a laser is used to vaporize the coating material. This process can be considered Laser Beam PVD. The process will be described and some solubility tests that can be related to permeation will be presented.

In addition, samples coated with simple and complex aluminide compounds using conventional diffusion coating processes have been tested using a Savannah River National Laboratory (SRNL) permeation testing rig. The results indicate that the problems of hydrogen isotope permeation are not resolved and that further understanding of the growth and morphology of permeation barrier coatings is needed. In fact, the permeation rates for the complex aluminide coated samples are higher than the simple aluminide coated samples. The results of these studies, suggestions for future work, and available equipment will be presented.