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Analysis of Tritium in Divertor Materials

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The accumulation of tritium in fusion devices, especially divertor region, has always been a major difficulty. The 15 – 25 micrometres tungsten W coating with Mo or Rh interlayers for carbon fibre composite (CFC) material is proposed as the latest upgrade for pure CFC divertor tiles used before. Coating should decrease the sputtering of plasma facing materials, accumulation of tritium on the surface and in the bulk of divertor materials.
To analyse the efficiency of W coating the series of experiments were conducted evaluating the effect of W coating on reducing surface and bulk tritium accumulation. Samples from JET fusion device MkII-HD and MkII-HD ILW divertor configurations were analysed – particularly floor tiles 4 and 6 and lower outer divertor circle tiles 7.
To determine the total amount and location of tritium were used full combustion and liquid scintillation counting methods.
For floor tiles 4 with applying W coating, surface tritium activity reduced by a factor of 20, also reducing bulk tritium activity by more than 4 times. As a result of less divertor material erosion and further tritium accumulation in erosion materials, bulk activity is also diminished.
W coating on floor tiles 6 reduces the total amount of tritium collected, yet the effect is much less significant than for tile 4 being under more frequent plasma interaction during fusion. Bulk activity remains almost the same for samples of this tile. It can be concluded that kinetic collision-like tritium access through the surface of divertor tiles is much less influent for the bulk activity. Tritium bulk activity levels are most likely driven by diffusion processes. The reducing effect of W coating is even smaller for tile 7 samples. While coating slightly decreases the tritium surface activity, the bulk activity remains similar to previously described tiles.

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