Tritium absorption of co-deposited carbon film and polycrystalline tungsten

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Tritium retention in plasma facing materials is a primary issue for ITER and next step fusion devices, since it greatly affects its safety and operational schedule. In ITER, carbon and tungsten will be used as divertor materials. Carbon materials are easily eroded by incident hydrogen particles and the sputtered carbon atoms are co-deposited on the walls. For prediction of in-vessel tritium inventory in ITER, it is important to investigate the amount of absorbed tritium in co-deposited carbon film and tungsten. In the present study, co-deposited carbon film, tungsten and isotropic graphite were exposed to tritium gas, and then the amount of absorbed tritium was evaluated.

The tritium exposure experiment was conducted in Toyama University using a special chamber for tritium gas exposure. In the chamber, co-deposited carbon film, polycrystalline tungsten and isotropic graphite were exposed to tritium gas. During the tritium exposure, the partial pressure of tritium gas was kept at 10 Pa. The samples temperature was 423 K and 523 K. After the tritium exposure, samples were extracted from the chamber and the amounts of absorbed tritium were evaluated by β-ray-induced X-ray spectrometry (BIXS) and imaging plate (IP) technique.

The amounts of absorbed tritium in co-deposited carbon films were one or two orders of magnitude larger than that of polycrystalline tungsten and isotropic graphite. The amount of absorbed tritium for co-deposited carbon film with a high volume density (1.53 g/cm^3) was several times larger than that of the film with a low volume density (1.14 g/cm^3). The amount of absorbed tritium at 523K was larger than that at 423K for all the materials used in the present study. These results indicate that co-deposited carbon films can absorb much larger amount of tritium than tungsten and graphite, and carbon film density affects the amount of absorbed tritium. Tritium absorption depends on tritium gas pressure. The pressure dependences of tritium absorption in these materials will be also presented.

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