

Status of plasma facing material studies and issues toward DEMO

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Choice of plasma facing materials (PFMs) and determination of appropriate plasma operation conditions for PFMs are critical issues for realization of fusion reactors. Tungsten is a leading candidate for PFMs because of a high melting point, a high thermal conductivity, a low sputtering yield by fuel ions, and low tritium retention. However, there are a lot of concerns for the use of tungsten such as helium effects on bubbles and nano-structures (related to plasma surface interaction issues), embrittlement by neutron irradiation (related to material issues), and avoidance of impurity accumulation in core plasma. The other material choice is CFC graphite, which has several advantages such as low impact on plasma operation and high thermal shock resistance, but it also has concerns such as high erosion due to chemical sputtering and tritium retention in codeposition layer.

In ITER, installation of full W divertor instead of CFC graphite at the vertical target of the outer divertor in the first phase of DT operation is under serious discussion. Many Japanese key researchers had a domestic meeting this May to discuss this issue and reached a conclusion to support CFC graphite in the first phase of the DT operation. But we need to take actions to resolve the concerns related to the use of CFC graphite and to develop fusion-relevant tungsten. Under these circumstances, understanding of basic mechanism of plasma materials interaction of W and CFC graphite, and development of suitable plasma facing components for ITER and DEMO become increasingly important.

In this presentation, I summarize the present understanding and the issues of plasma facing materials, especially tungsten and CFC graphite. And remaining issues toward DEMO as well as ITER are be discussed.