Analysis of plasma erosion in low activation high entropy alloy-based material for fusion plasma facing applications

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Fusion plasma is difficult to contain due to complex turbulent transport and magneto-hydrodynamics. Any failure in its confinement results in plasma hitting the walls of the reactor vacuum vessel, which causes damage including sputtering and erosion. The severity of the plasma conditions is expected to be unprecedented in future fusion reactors. Therefore advanced low activation materials are being developed for fusion plasma facing applications. A novel low activation high entropy alloy-based material, which is W\textsubscript{0.5}TaTiVCr, has promising strength and fracture toughness (when doped with pure W-based reinforcements) for fusion plasma-facing applications \cite{1}. In this work, the first direct comparative study of W\textsubscript{0.5}TaTiVCr and pure tungsten under identical plasma conditions was carried out. Erosion measurements were made using a new method for high-Z erosion quantification, utilizing implanted depth markers and nuclear reaction analysis \cite{2}, which also has applications for in situ measurements. In addition to plasma erosion, the effects of fusion plasma exposure on the surface morphology, microstructure, recrystallization, and mechanical properties were analyzed.

\cite{1} O. A. Waseem et al, Nucl. Fusion. 1-18 (2019) 59