

# The Use of Beryllium as a Plasma-Facing Material: Past, Present and Future

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Beryllium has been used as a plasma-facing material for decades and will continue being used for decades to come. A short historical perspective from its initial proof-of-concept use in UNITOR [1], through to its present use in the JET-ILW [2] and into predictions of how it will behave in ITER [3] will be presented. Measurements and modeling of the erosion behavior will be presented; including physical sputtering [4], chemically-assisted physical sputtering [5], enhanced sputtering at elevated temperature [6] and response to transient heat [7] and plasma [8] loads will be summarized. In addition to erosion, fuel accumulation in plasma-exposed beryllium surfaces [9] and Be-containing co-deposits [10] are critical issues for ITER as it prepares for burning plasma operation. Predictions of the location of co-deposit formation in ITER have been validated against measurements in the JET-ILW [11]. Along with differing locations, come differing conditions of temperature, deposition rate, energy and pressure where the co-deposits grow. These conditions determine not only the quantity of retention, but the mechanism responsible for that retention (for example, trapping in defects within the layer [12] vs. hydride formation [13]). Finally, the expected efficiency of various techniques (isotope exchange [14], flash heating [15], long-term baking [16], baking of previously baked co-deposits [17], etc.) for removing fuel atoms from beryllium surfaces and co-deposits will be presented along with the implications for ITER.

The views and opinions expressed herein do not necessarily reflect those of the ITER Organization.

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