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Plasma impurity co-bombardment effects on sputtering of Beryllium and Tungsten

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In future fusion reactor, ITER, plasma facing materials (PFMs) will consist of tungsten (W) and beryllium (Be). Ions from the plasma as well as injected noble gas impurities (argon (Ar) and neon (Ne) here) as a coolant for the plasma, will lead to sputtering of PFMs. To study the effect of plasma impurities on the erosion and surface morphology of wall materials, molecular dynamics simulations were carried out. Therefore, we modeled irradiation of both W and Be surfaces with Ar-deuterium (D) and Ne-D mixtures, varying the fraction of Ar and Ne impurities from 0 to 20 percent with impact energies of 10-100 eV at 500 and 800 K surface temperatures for W and impact energies of 30-200 eV at 400, 600 and 800 K surface temperatures for Be. In both materials, after a few hundred bombardments the sample surface was damaged and cell structures changed from crystalline to amorphous at lower ion energy and blistering-like effect was observed due to D2 accumulation in the Be cells at higher energies. In W only the noble gas impurities were responsible for surface erosion in the energy range studied here and the sputtering mechanism was in physical region. For Be at impact energies higher than 100 eV, total Be sputtering yield, in the presence of Ar and Ne impurities is around three times higher than pure deuterium irradiations. The effect of surface temperature on the results is negligible here.