Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Molecular dynamics simulations of growth and coalescence of helium nano-bubbles in tungsten ROMAN SMIRNOV, SERGEI KRASHENINNIKOV, JEROME GUTERL, UCSD — It was experimentally observed that filamentary nano-structures, called fuzz, can grow on tungsten surfaces irradiated with plasma containing helium. Although the mechanism of the fuzz growth is not clearly understood, experiments show that formation of helium nano-bubbles in tungsten always precedes fuzz creation. In this work we investigate mechanisms of growth and coalescence of helium bubbles using molecular dynamics code LAMMPS. We demonstrate that the growth process is governed by crystal symmetries and properties of generated dislocations forming helium nano-bubbles of non-spherical geometry. This produces complex stress field in the tungsten lattice around the bubble with distinct compression and tension regions. We show that helium transport in the stressed lattice in bubble vicinity can be dominated by drift from the compression to tension regions. Helium transport coefficients in tungsten are also obtained. Modeling of two closely positioned helium nano-bubbles demonstrates that their coalescence proceeds preferentially by lateral growth. The implications of the obtained results on fuzz formation mechanism are discussed.

R.D. Smirnov
UCSD

Date submitted: 10 Jul 2014 Electronic form version 1.4