Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Deciphering gas implantation rate effects on bubble nucleation in tungsten ZHANGCAN YANG, BRIAN WIRTH, Department of Nuclear Engineering, University of Tennessee — We use the object kinetic Monte Carlo code KSOME to study the sub-surface helium clustering behaviour in tungsten at various conditions relevant to plasma exposure of divertor surfaces. In particular, we have investigated helium implantation fluxes from 10^{20} to 10^{27} $m^{-2}s^{-1}$ at temperatures from 400K to 1600K for 100-eV helium ions implanted below tungsten surfaces as a function of pre-existing vacancy concentration. For these conditions, the helium retention rate, the surface areal density of adatoms, and the number density of clusters are analysed. A phase diagram is constructed to summarize the results, which maps the ratio of self-trapped helium to vacancy-trapped helium with respect to the helium flux, the target temperature, and the concentration of pre-existing vacancy. According to the phase diagram, the boundary between the self-trapping dominant regime and the vacancy-trapping dominant regime can be distinguished. In general, pre-existing vacancies are dominant in trapping helium atoms for low fluxes and high temperatures, while self-trapping is dominant for high fluxes. These results provide important insight into the mechanisms of helium clustering for plasma facing components in fusion reactors.

Zhangcan Yang
Department of Nuclear Engineering, University of Tennessee

Date submitted: 23 Jul 2015 Electronic form version 1.4