Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Impact and effects of simultaneous MeV-ion irradiation and helium plasma exposure to the formation of tungsten nano-tendrils[1] GRAHAM WRIGHT, LEIGH ANN KESLER, DENNIS WHYTE, Plasma Sceince and Fusion Center, MIT, Cambridge, MA — The extrusion of nano-tendrils from high temperature (>1000 K) tungsten (W) targets exposed to helium (He) plasma ions remains a concern for future fusion reactors. Previous work on the Alcator C-Mod tokamak has demonstrated it is possible to form these structures in a tokamak environment. However, one area where Alcator C-Mod and a fusion reactor differ is total neutron flux at the wall and the displacement damage these neutrons produce in the plasma-facing materials. This dsiplacement damage may affect the size and number He bubbles precipitating in the W target, which is a key factor in the formation and growth of the nano-tendrils. The DIONISOS experiment directly measures the impact of the displacement damage by simultaneously bombarding high temperature W targets with MeV-range ions (to simulate the displacement damage caused by neutron flux) and high flux of He plasma ions. Different combinations of irradiating ion species and W target temperatures are used to vary the different processes and rates that are involved such as He trapping rate, vacancy production and annealing rates, and nano-tendril growth rate. The nano-tendril growth is characterized by SEM imaging and focused ion beam (FIB) cross-sectioning and compared to nano-tendril formation without the presence of the irradiating ion beam.

[1]This work is supported by US DOE award DE-SC00-02060.

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Date submitted: 23 Jul 2013 Electronic form version 1.4