A experimental-numerical study of microstructural evolution of tungsten under fusion conditions.

Tungsten is the candidate material for the plasma facing components of the fusion reactor. This talk will address the bulk microstructure evolution of these W plasma facing components by means of an experimental-numerical approach, where feasible experiments on bulk W under thermal loads are performed, while the influence of synergistic particle and heat loads on microstructural changes are numerically modelled. Under high cyclic thermal loads, significant recrystallization of the W monoblocks is observed, whilst superior thermal fatigue performance. To assess the microstructure-property changes, high temperature tensile and small punch test are performed, while the temporal evolution of the recrystallized fraction in presence of a cyclic temperature gradient is modelled numerically. Moreover, to capture the synergistic defect dynamics due to neutron and ion irradiation in presence of a temperature gradient, a spatially dependent cluster dynamics model applied to a W monoblock geomtery is developed.