**BACKGROUND**

- Tungsten is a candidate material for plasma facing components in the future STEP device [1]. It is known for having a high melting point (3693 K), low sputtering yield and resistance to oxidation [2][3][4].
- Tungsten will experience neutron, He and tungsten sputtering.
- The influence of He on Tungsten is dependent on the temperature, where a nanostructure known as Fuzz forms at temperatures between 900-2000K [5].
- The presence of tungsten particles in the plasma will have a direct impact on the first wall, it will experience tungsten flux and a change in the fuzz formation mechanism is expected as a result.

**AIMS**

- Carry out simultaneous He irradiation and tungsten deposition on STEP relevant tungsten material at a range of temperatures and fluences.
- Characterise He bubble sizes using SEM imaging and small-angle scattering techniques.
- Correlate bubble formation with its impact on recrystallisation.

**METHOD**

- **Heat treatments** of tungsten will be carried out prior irradiation to relieve the stresses and harmonize the microstructure, shown in fig.1.
- **Irradiation** will take place at MAGPIE linear plasma device-Australia, fig 5 shown a schematic representation of the device.
- **Scanning Electron Microscopy (SEM)** will be used to analyse the surface modifications and bubble formation due to the He plasma exposure in the presence of tungsten deposition.
- **Electron Backscatter Diffraction (EBSD)** will be used to analyse the microstructure and quantify orientation dependent effects of the He plasma exposure. Furthermore, EBSD will be used to determine the effect of He plasma exposure on changes to the microstructure following recrystallisation heat treatments.
- **X-ray diffraction** will help in identifying the elements that exist within the sample prior and after irradiation.
- **GISAXS** will be used to characterise the He bubble structure and lattice strain as shown in fig.6.

**APPLICATION**

- It is vital to fully understand the impact of fusion relevant He exposure combined with plasma impurities on the morphological changes to tungsten and the consequences on recrystallisation response to accurately predict reactor performance.

**FUTURE WORK: Year 2 & 3**

- Proton/Neutron irradiation of the samples that are He irradiated and tungsten sputtered.
- Simulations of He bubble evolution to blistering and ablation in W-alloys surface.

**REFERENCES**