1. Introduction
- Tungsten will be used as a divertor plate material in ITER and was selected for the first wall armor of the High Average Power Laser (HAPL) chamber.
- The newly constructed Materials Irradiation Experiment (MITE-E) was used to irradiate polycrystalline tungsten (PCW) samples for this study.
- The MITE-E has improved current monitoring, temperature control, and dose rate variability as compared with previous devices used for materials tests at the UW-IEC.

2. Experimental Setup
Samples: electropolished PCW

- Pyrometer
- Ion gun
- Laser light
- Plasma/beam
- Sample
- Laser
- Ion gun

Figure 1: Solidworks™ model of the inside of the MITE-E vacuum vessel.

Features of the MITE-E:
- Ion gun: 8 mm diameter, normal incidence beam of 30 keV He+ ions; I = 75 µA
- Nd-YAG laser: additional sample heating

3. Results

3.1 Fluence Scan at 900 °C

- Figure 2: As fluence was increased on PCW samples irradiated with 30 keV He+ at 900 °C, the surface morphology changes became more severe—starting with (a) small pores and grain shifting, evolving to (b) blisters and pores, then (c) blister remnants and "grass," and finally (d) "grass" alone.

![Image](image-url)

4. Discussion

4.1 "Grass" Structure
Factors that contribute to growth of "grass" structure:
- Helium bubble movement
- Orientation dependence of sputtering yield

![Image](image-url)

4.2 Blisters
- Key factor: mono-energetic ions
- Unlikely that fusion reactors’ plasma facing components (PFCs) will form blisters
- No second generation of blisters was observed.

![Image](image-url)

5. Conclusions
- The angle of incidence of He bombardment of PCW greatly impacts the surface morphologies that develop.
- The grass structure is believed to be influenced by helium bubble movement and sputtering variation across grains.
- If fusion reactors experience mass loss near what was observed on the samples, it will make PFC lifetimes too short to be viable.