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Materials research for PMI at Oak Ridge National Laboratory[1]
CHAD PARISH, PHILIP EDMONDSON, FRED MEYER, MARK BANNISTER, LAUREN GARRISON, KINGA UNOCIC, XUNXIANG HU, YUTAI KATOH, Oak Ridge National Lab — In order to improve the scientific understanding of how materials' structure influences plasma-materials interactions (PMI) and the material response to plasma effects, we have performed a series of ion- and neutron-irradiation experiments on tungsten (W). Single- and polycrystal tungsten developed second phase Re+Os precipitates due to transmutation from High-Flux Isotope Reactor (HFIR) neutron irradiation. The microstructure of these precipitates was investigated with electron and atom probe microscopy, while mechanical testing found a significant degradation in materials properties, such as toughness and strength, which will degrade PMI performance. We have also used a beam-deceleration module on an electron-cyclotron resonance ion source beamline at ORNL to study the effects of W crystallography (specifically surface normal) and the effect of beam incidence angle and beam energy on surface morphology after irradiation. Ongoing plasma-exposure experiments and neutron-irradiation campaigns will be described.

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