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Simulating tokamak PFC performance using simultaneous dual beam particle loading with pulsed heat loading[1] GREGORY SINCLAIR, SEAN GONDERMAN[2], JITENDRA TRIPATHI, TYLER RAY, AHMED HASSANEIN, Purdue University — The performance of plasma facing components (PFCs) in a fusion device are expected to change due to high flux particle loading during operation. Tungsten (W) is a promising PFC candidate material, due to its high melting point, high thermal conductivity, and low tritium retention. However, ion irradiation of D and He have each shown to diminish the thermal strength of W. This work investigates the synergistic effect between ion species, using dual beam irradiation, on the thermal response of W during ELM-like pulsed heat loading. Experiments studied three different loading conditions: laser, laser + He^+, and laser + He^+ + D^+. 100 eV He^+ and D^+ exposures used a flux of 3.0-3.5 x 10^{20} m^{-2} s^{-1}. ELM-like loading was applied using a pulsed Nd:YAG laser at an energy density of 0.38-1.51 MJ m^{-2} (3600 1 ms pulses at 1 Hz). SEM imaging revealed that laser + He^+ loading at 0.76 MJ m^{-2} caused surface melting, inhibiting fuzz formation. Increasing the laser fluence decreased grain size and increased surface pore density. Thermally-enhanced migration of trapped gases appear to reflect resultant molten morphology.

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