Abstract Submitted
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Ultrafast-electron-diffraction studies of predamaged tungsten excited by femtosecond optical pulses.[1] M. MO, Z. CHEN, R. LI, Y. WANG, X. SHEN, M. DUNNING, S. WEATHERSBY, I. MAKASYUK, R. COFFEE, Q. ZHEN, J. KIM, A. REID, K. JOBE, C. HAST, SLAC - Natl Accelerator Lab, Y. TSUI, University of Alberta, X. WANG, S. GLENZER, SLAC - Natl Accelerator Lab — Tungsten is considered as the main candidate material for use in the divertor of magnetic confinement fusion reactors. However, radiation damage is expected to occur because of its direct exposure to the high flux of hot plasma and energetic neutrons in fusion environment. Hence, understanding the material behaviors of W under these adverse conditions is central to the design of magnetic fusion reactors. To do that, we have recently developed an MeV ultrafast electron diffraction probe to resolve the structural evolution of optically excited tungsten. To simulate the radiation damage effect, the tungsten samples were bombarded with 500 keV Cu ions. The pre-damaged and pristine W's were excited by 130fs, 400nm laser pulses, and the subsequent heated system was probed with 3.2MeV electrons. The pump probe measurement shows that the ion bombardment to the W leads to larger decay in Bragg peak intensities as compared to pristine W, which may be due to a phonon softening effect. The measurement also shows that pre-damaged W transitions into complete liquid phase for conditions where pristine W stays solid. Our new capability is able to test the theories of structural dynamics of W under conditions relevant to fusion reactor environment.

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