

Abstract Submitted  
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**Static and dynamic structural evolution of Fe/Ni multilayers studied by an ultrafast optical pump/x-ray probe technique.** AARON LOETHER, BRIAN KELLY, University of Delaware, ANTHONY DICHARA, ROBERT HENNING, Argonne National Laboratory, MATTHEW DECAMP, KARL UNRUH, University of Delaware — The static and dynamic structural evolution of an Fe/Ni thin film multilayer has been studied utilizing the picosecond (ps) duration optical pump pulses and 100 ps duration x-ray pulses available at the BioCARS (sector 14) beamline at the Advanced Photon Source at Argonne National Laboratory. The time-resolved x-ray diffraction patterns of the as-prepared multilayers reflected the effects of both reversible thermal expansion and irreversible alloying of the Fe and Ni multilayers by solid-state diffusional mixing. On the other hand, the time-resolved diffraction patterns of a fully alloyed multilayer were only due to thermal expansion. Based on these two sets of measurements we conclude that optical excitation produces a lattice strain corresponding to a temperature rise of about 1000 K and a decay constant of 10s of nanoseconds (ns). In comparison, diffusional mixing takes place on a time scale about 10 times longer (i.e. on the order of 100s of ns). These time scales have been confirmed by the results of numerical simulations.

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