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The Effect of Disorder on Lattice Thermal Transport in Solid Solution Alloys RAINA OLSEN, Oak Ridge National Laboratory, BISWANATH DUTTA, Max-Planck-Institut fur Eisenforschung GmbH, GERMAN SAMOLYUK, BRIAN SALES, BEN LARSON, HONGBIN BEI, ELIOT SPECHT, MALCOLM STOCKS, Oak Ridge National Laboratory, THE ENERGY DISSIPATION TO DEFECT EVOLUTION ENERGY FRONTIER RESEARCH CENTER COLLABORATION — Dramatic decreases in radiation damage for 3- and 4-component equiatomic single phase solid solution Ni-based alloys have been recently observed. The strongly decreased damage retention in these highly disordered materials is attributed to severe disruption of the pathways of energy dissipation away from atomic displacement cascades. Because the energy of an irradiating ion is primarily deposited into the lattice degrees of freedom, it is the lattice thermal conductivity that is most important to the dissipation of heat from damage events. Here we report measurements of phonon linewidths in NiCo, NiFe, and NiFeCoCr using inelastic neutron and X-ray scattering, showing a dramatic increase in phonon linewidth by a factor of 4 with increasing disorder. Measured phonon linewidths are shown in comparison to theoretical phonon linewidths originating from disorder calculated using the itinerant coherent potential approximation (I-CPA). Lattice thermal conductivity is calculated from the phonon properties, and compared to measurements of bulk thermal and electrical properties. The impact of the observed decrease in lattice thermal conductivity on damage resistance is discussed.

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