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Viscoelastic damping in crystalline composites and alloys RAGHAVAN RANGANATHAN, RAHMI OZISIK, PAWEL KEBLINSKI, Rensselaer Polytech Inst — We use molecular dynamics simulations to study viscoelastic behavior of model Lennard-Jones (LJ) crystalline composites subject to an oscillatory shear deformation. The two crystals, namely a soft and a stiff phase, individually show highly elastic behavior and a very small loss modulus. On the other hand, when the stiff phase is included within the soft matrix as a sphere, the composite exhibits significant viscoelastic damping and a large phase shift between stress and strain. In fact, the maximum loss modulus in these model composites was found to be about 20 times greater than that given by the theoretical Hashin-Shtrikman upper bound. We attribute this behavior to the fact that in composites shear strain is highly inhomogeneous and mostly accommodated by the soft phase, corroborated by frequency-dependent Grüneisen parameter analysis. Interestingly, the frequency at which the damping is greatest scales with the microstructural length scale of the composite. Finally, a critical comparison between damping properties of these composites with ordered and disordered alloys and superlattice structures is made.

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