Electronic Supplementary Information

Dynamical solid-liquid phase transition through oscillatory shear

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I. SUPPLEMENTARY VIDEOS

- **sv1-LJ2d.mp4** The video shows the complete oscillations of the 2D Lennard-Jones system at temperature $T = 0.4$ and strain amplitude $\gamma_0 = 0.205$ color-coded by the modulus of the orientational order parameter.

- **sv2-LJ3dfccbcc.mp4** The video shows the time-evolution of the 3D Lennard-Jones crystal at temperature $T = 0.6$ and strain amplitude $\gamma_0 = 0.28$. In particular, it shows the initial amorphization of the fcc order, and the subsequent nucleation of the bcc order. We employ VoroTop [1] as implemented in Ovito [2] to identify fcc (blue), hcp (green), mixed fcc/hcp (light green), bcc (orange) and icosahedral (yellow) environments. Snapshots are taken only after entire oscillations, hence the box is always orthorombic.

- **sv3-768Kparticles.mp4** The video shows the order-disorder transition in a large 3D binary Lennard-Jones system of 768000 particles at temperature $T = 0.336$ and strain amplitude $\gamma_0 = 0.215$. Large and small particles are in red and blue respectively, while in green we represent the interface between ordered and amorphous regions (grey facets are in the periodic dimension). Snapshots are taken only after entire oscillations, hence the box is always orthorombic.

- **sv4-nucleus2.5.mp4** The video shows the growth of a seeded amorphous nucleus of radius $R = 2.5\sigma_A$ in the 3D binary Lennard-Jones crystal at $T = 0.336$ and $\gamma_0 = 0.21$. Large and small particles are in red and blue respectively, while in green we represent the interface between ordered and amorphous regions. Snapshots are taken only after entire oscillations, hence the box is always orthorombic.

[1] E. A. Lazar, Modelling and Simulation in Materials Science and Engineering **26**, 015011 (2017).
[2] A. Stukowski, Modelling and Simulation in Materials Science and Engineering **18**, 015012 (2009).

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