

## SUPPLEMENTARY MATERIAL

### I. Inelastic peak broadening for a-Si (A1 and A2) and numerical predictions

IXS measurements of both A1 and A2 samples are compared with dynamic structure factor calculations from molecular dynamics [38, 41, 42] in Fig. S1. The broadening values from Beltukov et al. [41] are taken from their raw data points from Fig. 9 of their paper. The broadening values from Larkin and McGaughey are taken from the dispersions in Fig. 3 of their paper [38]. Due to their limited number of raw data, we have plotted their calculations as data points rather than lines. All the simulations used Stillinger-Weber potential [31]. We see that the IXS measurements follow closely with prior MD predictions [38, 41, 42].

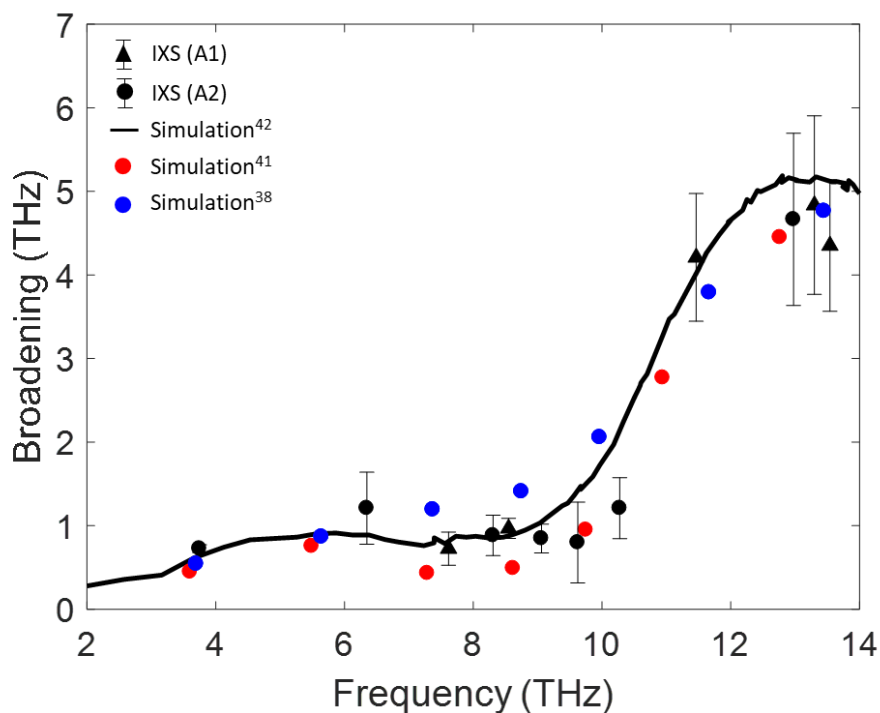


FIG. S1. Inelastic peak broadening of A1 and A2 (black filled circles) compared to dynamic structure factor calculations [38, 41, 42] versus frequency. The black solid line is from Moon et al. [42], red filled circles are from Beltukov et al. [41], and blue filled circles are from Larkin and McGaughey [38].

