How do the dynamics and structure evolve as glasses are heated across \( T_g \), the glass transition temperature? In covalent \( \text{Ge}_x\text{Se}_{100-x} \) networks\(^1\) three distinct regimes of network structure exist - (i) flexible, (ii) rigid but unstressed (Intermediate phase (IP)-blue region) and (iii) stressed-rigid. Upon melting, two distinct types of glass transitions manifest: IP glass compositions display a \( T_g \) with a minuscule enthalpy of relaxation (\( \Delta H_{nr} \sim 0 \)), while those outside the IP show a large \( \Delta H_{nr} \) (panel (b)). In contrast, fragility of melts, \( m(x) \) near \( T_g \) accessed from Complex \( C_p \) measurements\(^2\), and at \( T>>T_g \) from viscosity measurements\(^3\) show (panel(a)) that

- IP glasses give rise to strong (low \( m \)) liquids
- glass compositions outside the IP give rise to fragile (high \( m \)) liquids
- Bonding constraints operative in covalent glassy networks persist in melts as the three regimes in \( m(x) \) and \( \Delta H_{nr}(x) \) coincide in \( x \).

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(a) Viscosity derived fragility \( m (\bigcirc) \)^\(^3\). are unable to access fragility \( m \) at \( x > 25\% \) unlike complex \( C_p \) measurements\(^2\) from mDSC (●).
(b) The non-reversing enthalpy (●) from mDSC experiments show the 3 regimes of elastic behavior\(^4\) describing their underlying network structures.
Four graduate students (G) working towards their Ph.D. Dissertation benefit directly from the award. They also mentor and provide hands on experience to 2 undergraduates (U) and 2 high school (HS) students on glass science projects. UC’s Graduate School Summer Mentorship awardee, S. Ravindren has been working closely with A. Diebold and Z. Tyler on examining synthesis of homogeneous As-Se glasses and their characterization by m-DSC and Raman scattering. The two HS students, W. Van Hook and R. Bhageria have worked closely with K. Vignarooban and the PI on identifying improved synthesis routes to homogenize alkali-borate glasses leading possibly to sharply defined elastic phase transitions. These HS students have come to the lab once a week, on an average, during the entire year including summer.