V-E Phase Dynamics under Ultra-High Pressures

Dynamics of phase transition under ultra-high pressures is investigated by using nanosecond time-resolved nonlinear Raman spectroscopy and laser shock compression. Shock wave induced by intense pulsed-laser irradiation can instantaneously generate ultra-high pressures (>1 GPa) and enable to monitor time-evolution of phase transition. By using nonlinear Raman spectroscopy such as stimulated Raman scattering and coherent anti-Stokes Raman scattering, change of molecular structure can be monitored.

V-E-1 Nanosecond Rapid Freezing of Liquid Benzene under Shock Compression Studied by Time-Resolved Coherent Anti-Stokes Raman Spectroscopy

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Nanosecond time-resolved coherent anti-Stokes Raman spectroscopy is used investigate the shock-induced liquid-solid phase transition and crystallization of liquid benzene. Temporal evolution of the Raman shift of the ring-breathing and C–H stretching mode is investigated. A metastable super-compressed state and a liquid–solid phase transition are observed under shock compression. Time-resolved Raman spectra reveal that liquid state is initially a metastable state and rapidly transforms to the solid state within 25 ns under shock compression at 4.2 GPa.

V-E-2 Time-Resolved Coherent Anti-Stokes Raman Scattering of Cyclohexane under Shock Compression

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Time-resolved coherent anti-Stokes Raman scattering has been performed on cyclohexane under laser-driven shock compression of up to 2 GPa. The ring-breathing and C–C stretching mode exhibits blue shift, which agrees well with that obtained by static-compression experiments. The intensity increase of the shifted peak due to the propagation of the shock wave is observed. Shock velocity is obtained using anti-Stokes Raman scattering signal intensity ratio, and agrees well with that estimated from the measured particle velocity and Hugoniot.