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High Pressure Light Scattering Study of Relaxation in the Glass Former Cumene[1] TIM RANSOM, KEVIN LYON, WILLIAM OLIVER, University of Arkansas — To understand relaxation dynamics in glassy systems, a light scattering study on Cumene has been carried out in a diamond anvil cell (DAC) at pressures from 0.2 GPa to 2.5 GPa isothermally at 75 °C. Polarized and depolarized spectra were taken in both near-backscattering and equal-angle 60° forward-scattering geometries at several free spectral ranges from 0.5 GHz to 300 GHz. Depolarized backscattering spectra are converted into susceptibility featuring the evolution of the α-relaxation peak, yielding structural relaxation times τ_α from 10 ps to 1 ns. We have also developed photon correlation spectroscopy (PCS) in a DAC, giving τ_α from $\sim$ 1 μs to 1 s. We fit τ_α over these many decades with a modified VFTH equation $\tau_\alpha = \tau_0 \exp[DP/(P_0\text{-}P)]$ giving parameters τ_0 = 9.2 ps, D= 17.5, and P_0 = 4.5 GPa at 75°C. After the α-relaxation peak moves into lower frequencies (P $\sim$ 1 GPa), we observe the emergence of the β-relaxation minimum region. We fit the β-minimum to a power law scaling form $\chi"(\omega) = b(\omega/\omega_{min})^a + a(\omega_{min}/\omega)^b$. Polarized backscattering and forward scattering gives frequency shift ω_B and linewidth Γ_B values of the longitudinal acoustic modes at two different q. We observe that the usual peak in linewidths does not coincide with $\omega_B \tau_{alpha} \approx 1$, indicating that the longitudinal acoustic modes do not couple with structural relaxation. Tansverse acoustic modes also appear in the depolarized forward scattering spectra.

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