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Regimes of resonance Raman utility: studies in diluted liquid benzene CHRISTOPHER CHADWICK, HANS HALLEN, North Carolina State University, ADAM WILLITSFORD, C. RUSSELL PHILBRICK, Pennsylvania State University — Resonance Raman yields huge increases in cross section as the excitation laser is tuned through an absorption band. Unfortunately, the measured signal levels do not always correspondingly increase. We use a tunable laser source to investigate this phenomenon with three different concentrations of liquid benzene in heptane as well as pure liquid benzene. Resonant Raman signal enhancement of the ring-breathing mode ($992\,cm^{-1}$) has been confirmed. Additionally, species absorption limitations on this enhancement has been identified. Two different regimes have been identified where resonance Raman can be applied to enable spectrographic information where the signal level of non-resonant Raman is not measurable. While Raman scattering intensities are largely dependent on the number of scattering agents in the non-resonant case, when probing electronic absorption features in a species with the excitation light, enhancement yields a significant signal output even as the number of scattering agents is reduced. The enhancement gains of the signal to noise for resonant probing are superior in low concentrations and tiny interaction volumes. This enhancement characteristic has broad application for materials identification in trace species such as remote sensing and tiny sampling volumes such as near-field optical microscopy.

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