

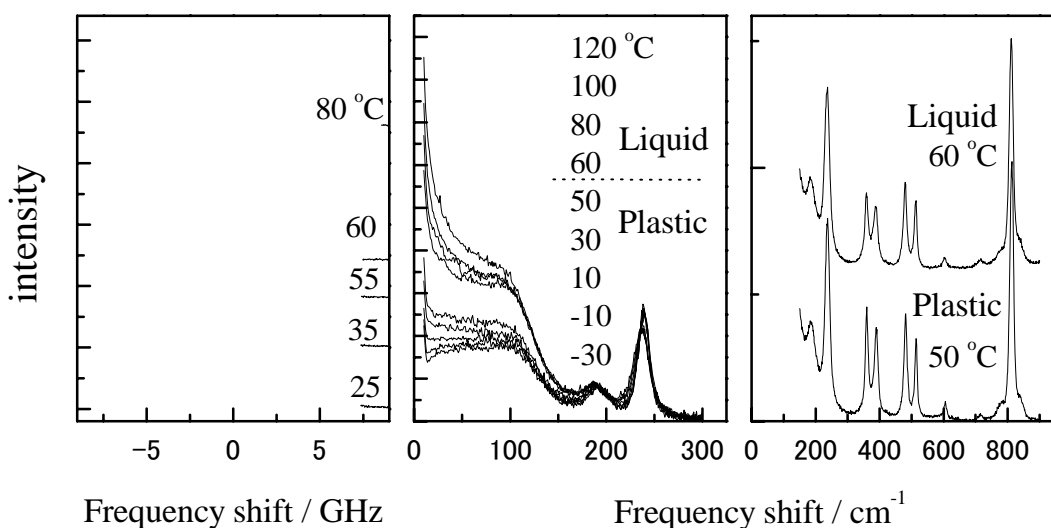
Onset of the dynamical difference between plastic and liquid phases of succinonitrile studied by light scattering experiment

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Starting from a basic question, what causes the large difference in the macroscopic nature between liquid and plastic phases such as plasticity, sound velocity and so on, we have performed light scattering experiments in both phases of succinonitrile around the phase transition temperature of 58 °C. By the use of two spectrometers, a Sandercock type tandem Fabry-Perot interferometer and a double monochromator, light scattering spectra for a wide frequency range from 0.003 to 3000 cm^{-1} have been obtained.

It was found that the intramolecular vibrational modes appearing in the higher frequency above 150 cm^{-1} do not show the large change in two phases (right figure), indicating the molecular structures are similar to each other. In contrast, the Brillouin peak shifts jump at the transition temperature (left figure) reflecting the difference of the elasticity as a macroscopic character in two phases. The transition from the similarity in higher frequency to the jumps in lower frequency lies in the so-called low-frequency phonon modes ($< 150 \text{ cm}^{-1}$ in the center figure), implying that the cooperativity among various phonon modes is essential for the manifestation of macroscopic nature.



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