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Pressure response of the FC70 Fluorinert™ studied by Raman spectroscopy

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Abstract: FC70 Fluorinert™ (Perfluorotripentylamine) is an important liquid with a wide range of applications in electronics for vapor phase soldering and thermal management, as well as material science, because of its unique properties (thermal and chemical stability, compatibility with sensitive materials etc.). It has been also widely used in high pressure diffraction or spectroscopic studies as pressure-transmitting medium and, hence, knowledge of its Raman spectrum and pressure evolution is particularly useful. In this work, Raman spectroscopy (λ_{exc}= 515 nm) has been used to study the pressure response of FC70. Hydrostatic pressure up to 5 GPa was applied by means of a diamond anvil cell, while pressure was calibrated by the ruby fluorescence technique.

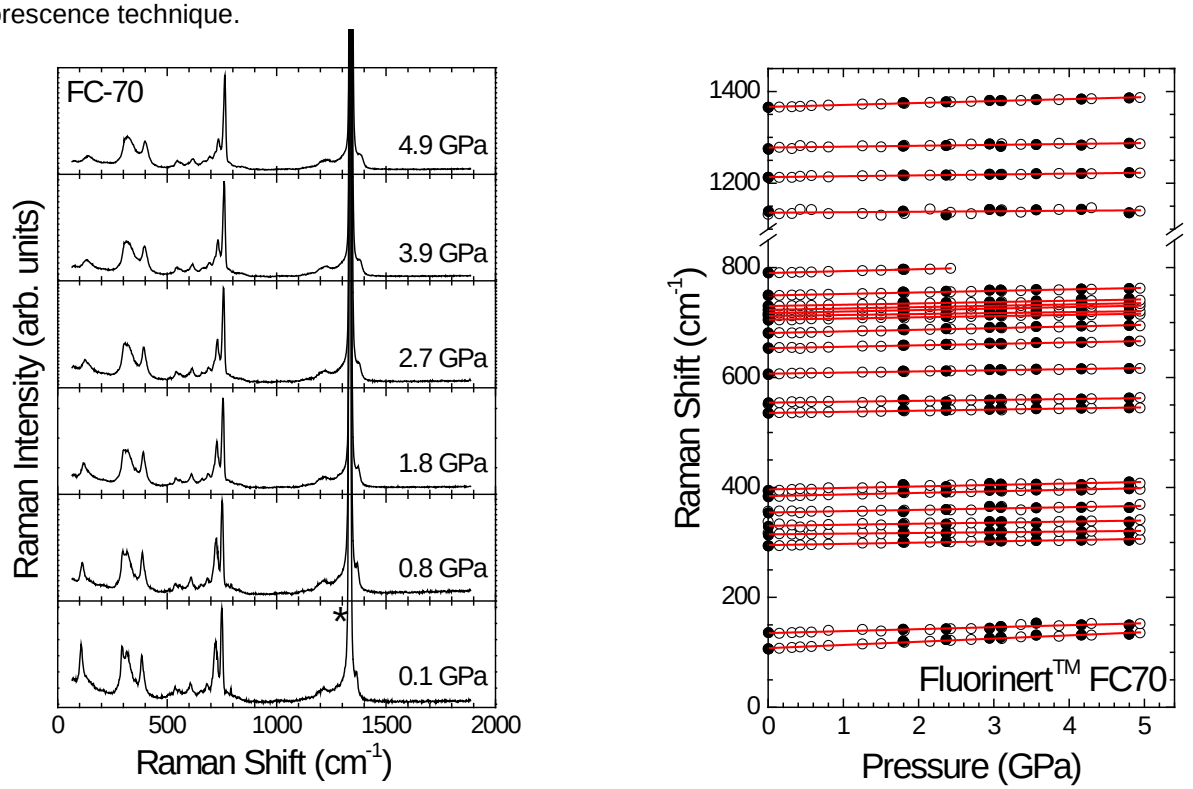

Figure 1. *Pressure evolution of the FC70 Raman spectra and pressure dependence of its Raman peak frequencies.*

With increasing pressure, all Raman peaks shift to higher frequencies, while no significant changes in the general spectrum profile occur up to 5 GPa with respect to the number of the Raman peaks, their linewidths and relative intensities (Figure 1). The only exception is the lowest frequency peak at 108 cm^{-1} that exhibits a continuous broadening and intensity attenuation with pressure. Previous studies have shown that FC70 becomes non-hydrostatic for P> 0.6 GPa due to its solidification. However, the pressure evolution of the frequencies of all the observed Raman peaks is quasilinear up to the maximum pressure attained in our experiments (5 GPa) with the corresponding pressure slopes ranging between 1.1 and 5.8 $cm^{-1}GPa^{-1}$. Moreover, the pressure-induced shifts of the frequencies of the Raman peaks are fully reversible upon pressure release. Consequently, despite its solidification, the pressure response of the frequencies of the Raman peaks and the overall spectrum profile remain unaffected for pressures at least up to 5 GPa, justifying its use as pressure transmitting medium.