Reference paper :

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Time-resolved optical Kerr-effect investigation on CS_2/polystyrene mixtures

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The relaxation dynamics of carbon disulfide are investigated in mixtures with polystyrene (PS) using the time-resolved optical heterodyne-detected optical Kerr effect (OHD-OKE). The data are analyzed using both the model-dependent approach, which assumes four distinct temporal responses, and the model-independent Fourier transform approach, which generates a spectral response that can be compared with results obtained by depolarized Rayleigh scattering. A slow dynamics is observed for the OHD-OKE transient decaying exponentially with a time constant that varies from 1.68 ps for neat CS_2 to 3.76 ps for the most concentrated CS_2/PS mixture. The increase of this time constant accompanies an increase in the viscosity of the mixture, so we can associate this component with the diffusive reorientation process of the induced polarizability anisotropy of the carbon disulfide in the mixture. The short-time nuclear response is characterized in the frequency domain by a broad band that peaks around 30 cm^{-1} for neat carbon disulfide, and is associated with a complex relaxation pattern. The vibrational distribution shifts to higher frequencies when the PS concentration is increased in the mixture. This result is discussed in terms of an increase in the interaction strength between the PS phenyl rings and the carbon disulfide molecules. [DOI: 10.1063/1.1994850]

setup

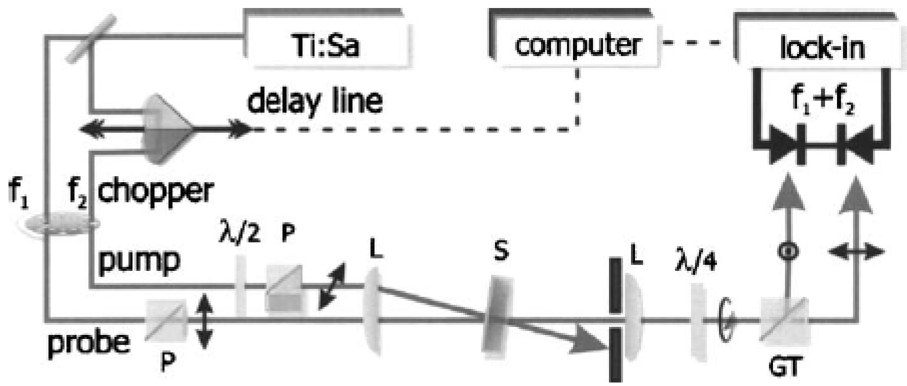
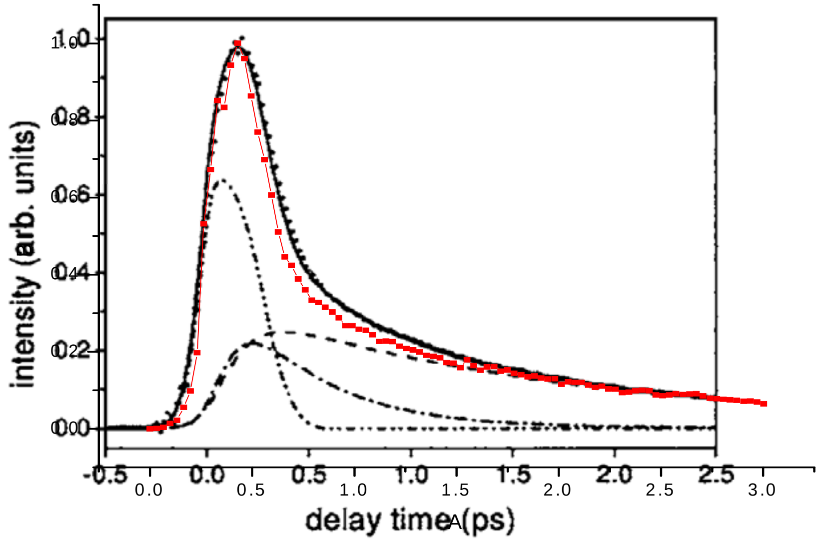


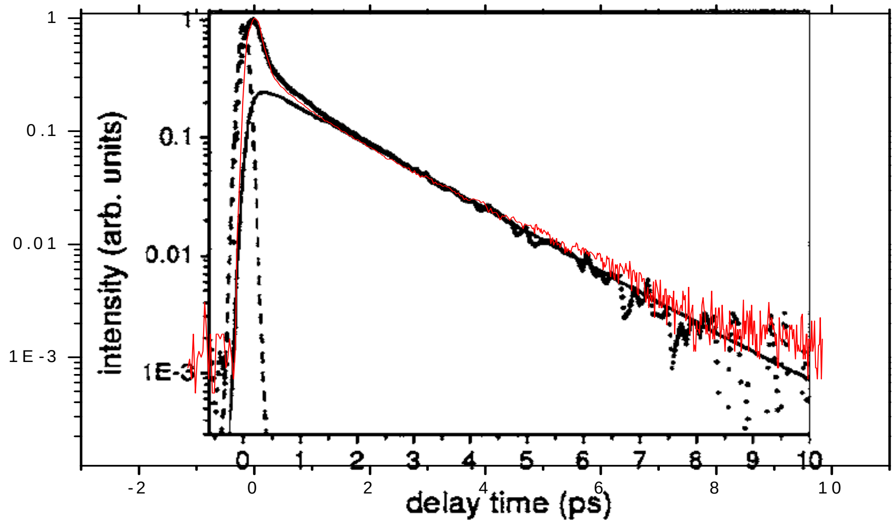
FIG. 1. Experimental setup. P: polarizer, L: lens, S: sample, GT: Glan-Thompson polarizer. λ/2 and λ/4 are zero-order half-wave retardation and quarter-wave retardation plates, respectively.

Sample : CS_2
Laser : Ti:sapphire (Mira 900 Coherent) pulse duration 100fs wavelngth 780nm
Delay line step motor resolution : 16.7fs/step

Our data

Reference data





The OHD-OKE signal $I(\tau)$

$$I(\tau) \propto \int dt A_c(t) R(\tau - t) = A_c(t) \otimes R(t) = A_c(t) \otimes [\sigma(t) + r(t)]$$

$$r_1(t) = a_1 \exp(-\frac{t}{\tau_{diff}})(1 - \exp(-\frac{t}{\tau_{rise1}}))$$

$$r_2(t) = a_2 \exp(-\frac{t}{\tau_{\text{int}}})(1 - \exp(-\frac{t}{\tau_{rise2}}))$$

$$r_3(t) = a_3 \exp(-\frac{\alpha^2 t^2}{2})(\sin(\omega_0 t))$$

$A_c(t)$: autocorrelation function

$r_1(t), r_2(t), r_3(t)$: response function

fitting parameter

% by wt of PS in the mixture	0
a_1 [a]	0.17
τ_{dif} (ps) [b]	1.68
a_2	0.28
τ_{int} (ps) [c]	0.40
a_4	0.00
τ_{pol} (ps) [d]	⋯
a_3	0.55
α (ps^{-1}) [e]	5.40
ω_o (ps^{-1}) [f]	6.72

$\tau_{rise1}, \tau_{rise2} = 0.4$