

Supplementary Materials

for

Accuracy of Measurements of Thermophysical Parameters by Dual-Beam Thermal-Lens Spectrometry

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Table S1. Nomenclature of thermal-lens measurements.

Symbol	Transcript
A	Absorbance
α	Linear absorption coefficient
c	Concentration, mol/L
d_{av}	Average distance between molecules, nm
D	Thermal diffusivity, mm ² /sec
\tilde{D}	Effective thermal diffusivity, mm ² /sec
dn/dT	Temperature coefficient of the refractive index
$I(t)$	Intensity of the probe beam in time, mV
$\tilde{I}(t)$	Normalized (the range of 0–1) intensity of the probe beam in time
$I(0)$	Intensity of the probe beam at time $t = 0$, mV
$I(\infty)$	Intensity of the probe beam when the stationary (steady) state, mV
ϕ	Phase shift
f_e	Focal length of the excitation laser lens, mm
f_p	Focal length of the probe laser lens, mm
k	Thermal conductivity, W/(m·K)
l	Cell path length, cm
m	Ratio of the radii of the probe beam to the excitation beam (mode-mismatch parameter)
P	Excitation laser power, W
t	Time
T	Temperature, K
t_c	Characteristic time, ms
$t_{c,thor}$	Theoretical value (true value) of the characteristic time, ms
$t_{c,exp}$	Apparent characteristic (experimental value) time, ms
\tilde{t}_c	Effective characteristic time, ms
v	Modulator (Shutter) frequency, Hz
V	Distance parameter
z_1	Distance between the probe beam waist and the sample
z_2	Distance between the sample and the detector
z_{ce}	Confocal distance for probe beam (Rayleigh length for probe beam), mm
z_{cp}	Confocal distance for excitation beam (Rayleigh length for excitation beam), mm
λ_p	Wavelengths of the probe lasers, nm
λ_e	Wavelengths of the excitation lasers, nm
θ	Thermooptical signal
ω_{e0}	Radius of the waist of the excitation beam, μm
ω'_{e0}	Incorrect radius of the excitation beam, μm
ω_{p0}	Radius of the waist of the probe beam, μm
ω_{p1}	Radius of the probe beam in the sample, μm
Δ	Absolute error, %

Table S2. Examples of geometric parameters of spectrometers for dual-beam TLS in the far field, where measurements are carried out according to the Shen-Snook model.

Purpose of the work	ω_{e0} , μm	ω_{p1} , μm	m	V	z_2 , m	Ref.
Shen-Snook model	46.3	236	26.0	1.73	5	[1]
	80	190	5.6	1.73	6	
Measurement of thermal diffusivity of nanofluids	20.4	338.3	47.93	6.01	3.82	[2]
Biodiesel Analysis	30.5	212	48	1.79	-	[3]
Investigation of thermo-optical properties of glasses	37.2	144.5	15.089	2.092	-	[4]
Measurement of the thermal diffusivity of aqueous dispersions of NPs	38	404	36.9	9.35	4.04	[5]
Investigation of water–ethanol systems	40	100	6.3	-	-	[6]
Measurement of thermal diffusivity of dispersions of nanoparticles	40	190	22.6	-	-	[7,8]
Investigation of the solvent effect on TL	41.0	65.0	2.51	-	2.5	[9]
Investigation of water-organic binary systems	41	100	6.3	-	-	[10]
Investigation of the thermal and optical properties of glasses	42	104	6.1	-	-	[11,12]
Investigate the thermo-optical properties of glasses	43	195	20.6	1.81	2	[13]
Check the validity of the theoretical predictions	44.5	88.9	4.0	-	-	[14]
Analysis of soybean oil, biodiesel, and soybean oil–biodiesel blends	45.9	-	-	1.81	4	[15]
Measurement of thermal diffusivity of nanocomposites from acrylic resin	49	181	13.691	1.33	-	[16]
Investigation of the quantum yield and thermal diffusivity of glasses	49.7	218.4	19.3	-	-	[17]
Determination of lead(II)	50.3	71.1	2	-	1.19	[18]
Investigation of thermo-optical properties of glasses	55	167	9.3	3	-	[19]
Check the validity of the theoretical predictions	56.2	43.3	0.59	-	-	[14]
Investigation of aqueous fullerene dispersions	58.5	82.1	1.97	1.01	-	[20]
Determination of the chelate concentration adsorbed on a quartz surface	60	84.9	2.0	3.1	1.2	[21]
Investigation of the quantum yield and thermal diffusivity of glasses	62	88	2.0	-	-	[12]
Investigation of the quantum yield and thermal diffusivity of glasses	62.6	90.5	2.1	-	-	[12]
Analysis of biodiesel fuel	63.0	539.5	73.3	3.99	4.0	[22]
Investigation of the thermo-optical properties of amorphous SiN	64	205.4	10.3	1.7	-	[23]
Determination of copper(I)	65	94.2	2.1	3.1	0.9	[24]
Investigation of thermo-optical properties of glasses	66.5	206	9.6	4	-	[19]
Investigation of the photostability of soybean oil	68	366	29	6.5	4.5	[25]
Investigation of the thermal diffusivity of NPs	92.3	195	4.46	-	-	[26]
Monitoring of the ester production	100	240.8	5.8	1.2	-	[27]
Analysis of diesel/biodiesel blends	119	429	13	3.88	-	[28]

Analysis of biodiesel fuel	188.0	675.0	12.9	14.2	4.0	[22]
Investigation of the quantum yield of doped glasses	-	-	30	19	-	[29]
	33.0	60.0	3.3	2.74	0.6	
This work	42.0	60.0	2.0	2.74		
	82.0	100	1.5	5.61	2.3-3.1	

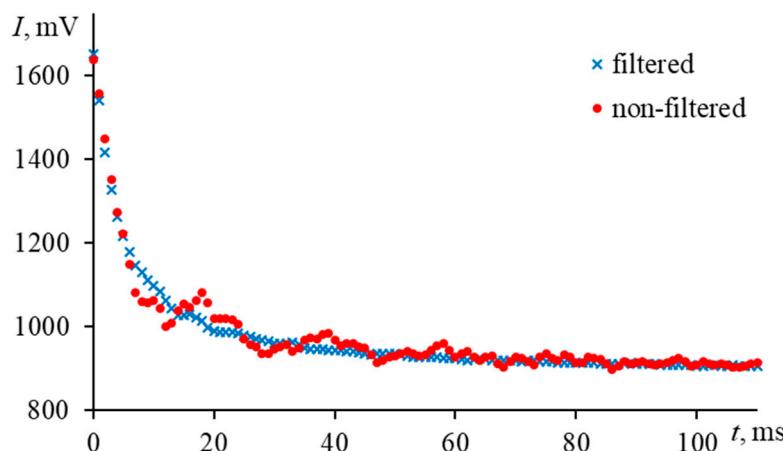


Figure S1. Transient curves for filtered and non-filtered aqueous solution of ferroin ($2.5 \mu\text{mol/L}$); narrow-focused configuration ($\omega_{e0} = 33 \mu\text{m}$, Figure 1, Table 3).

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