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TECHNICAL AND APPLICATIVE ASPECTS OF THE QUASIELASTIC SCATTERING OF AR^{+} ION LASER LIGHT

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Introduction

The development of electronics, laser and electronic technique has considerably affected the accuracy of measurements and the development of further possibilities of evaluation from data of quasielastic scattering of guasielastic scattering of laser light. Some milieu with small molecules were considered, standard milieux (but always topical) of polystiren spheres as well as DMAB in aqua solutions. Phytol-quinoline milieu though of interest shows the problems of purely technical nature.

A brief discussion is given in the light of theory which is to be included in the interpretations. The measurements of the phytol - quinoline in the light of integral scattering is also of interest / 1 / since the milieu where is a tendency of forming dimmers is involved, which we get from the laser light scattering an integral type and from the Brillouin spectra /1-5/.

CONTEMPORARY APPLICATIONS OF LIGHT SCATTERING

The light scattering as a method and a measure of the fluctuations in materials uses many domains, including critical phenomena and phase transitions. Using the approach of the parallel between magnetics, solutions and pure materials /5,6/ new parallels connected to the chaos are revealed. The transition of the excellent order into chaos is also connected to quantum generators, i.e. their coherence, either of the complex theoretical models or for the case when it is used as a part of the light oscilloscope device, where some transience into chaos will be presented. It is a domain where the story of fine mirror processing "falls into water", since instead of a mirror a trivial device could be placed and on the other side an expensive device. We start from the Hacken principle and parallels. The laser is used as a device in the method of dynamic light scattering. The principles holding for its work are parallel of the studies of the system fluctuations, or transient regime. The scaling and critical phenomena theories can be verified by means of the light scattering on the devices of both integral and spectral types.

Table 1 Characteristic components of measuring device

Laser	Ar Spectry Phys.	Krypton
	514.5nm, 800 mW	647.1 nm
lens, f	150mm	100mm
Cell diam.	18mm	8mm
D_1-D_2(diaphr.)	0.5-0.5mm	0.5-6.2mm
A_{coh}/A_{pm}	1	1
Mod	analog	digital
Channel number	400(Saikor 43A)	64(Malvern)

For the case of substances which are in powder, usually concentrated system is made ("mather solution") and the two times destilled water is added. The solution were according to needs centrifugated and obligatory filtered by Metricell--Gellman filters,

RESULTS AND DISCUSSION

SDS MEASUREMENT The SDS measurements are quite far one from the other may be due to polydispersity or due to instable solution in water. Taking that Einstein law is valid, the hydrodynamical radia are calculated of SDS micella. The data about D regard the translation and they are obtained through standard procedures. Comparing with literature, we can say that there are much more data obtained on SDS with salts. (They make the situation more stable, diffusion coefficients D_i much bigger and measurements repeatable).There are much more measurements with He-Ne laser and with weaker power. The question S/N is discussible, but taking into the account the detection technique the situation in our case is more complete. We present herewith the measurements from 5-60^o. According to the literature we agree that micelle radius increases with q. Our hydrodynamical radius grows with q and it was found that it amounts to 35.1 Å. The electrophoretical mobility provides the number of agregation and apparent charge can be evaluated further. Generally many different magnitudes from the literature can be obtained and verified by contemporary techniques, as well as the purification adequate. From the point of view of statistics, the errors are limited with precotions connnected to infinitive ideal solution or isoelectric point. As far as the polydispersity is concerned we consider it to be linked here only to the order of magnitude and not as in polystyrene case. The multimode work does not affects heterodyne and homodyne methods S/N does not infinitely increase with intensity and it is connected to the photomultiplier sensitivity. Unlike "pure" measurements " with a more sophisticated device (polystirene) this milieu though it represents much measured region, has more "enigmas".

POLYSTIRENE LATEX IN AQUAL SOLUTION (weak concentration) PLA measurements of D of PLA (0.109μm) is partially given in Table 2 are obtained from the series of 10 each gathered measuring points of the device with Malvern correlator. The averaging was done further according to the serial measurements (in total).

The application of the integral scattering to the study of fluctuations is connected to the obtaining data on nonlinear and hypersound characteristics. This is related to the definitions of the refraction index decrements as a consequence of isotropic and anisotropic fluctuations in material. By measuring Rayleigh factors and depolarisation we get the possibility to divide the scattering into R_{is}, R_{anis}, R_{dens}. Besides the links with increments (related to nonlinear optics) and hypersound material characteristics, there is also connections with constants of electrooptical nature (Kerr effect) /7/.

CORRELATION METHODS

The methods for dynamical light scattering can serve in the bioworld for investigation of various effects in vivo and in vitro, in the world of humane and lower structure organisms (bacterias, viruses ...). Apart from that they give very successfully the data on the medicament effects, the effect of a particular radiation (microwaves), nuclear radiation, time following of phenomena, analysis of progressive and nonprogressive scattering, analyses of "live-mobile" and "dead" (nonaddition to Brown movements). Brown's motion is modified by aliveness. All this is made possible by the analysis of correlation functions and spectra of DLS including the Rayleigh, Brillouin, Raman as well as Doppler spectral shifts.

EXPERIMENTS

The device is in two types of geometries: cylindric and rectangular: (according to the scattering cell) and in two assemblies of big and small angles. They have also the possibility to electrophoresis measurements. Therefore the scattering of several minutes to 12^{0} are measured with the He-Ne laser (80 mW) and with the Ar^{+} ion laser (till 1W), with angles till 60^{0}. Small angles correction is necessary. Optical focussing, detection with well defined diaphragm, electronic amplification with photomultipliers treatment of the spectrum and correlators were found as possible solutions. The selction of the devices of multichannel analyser of the correlator depends on the spectrum width, i.e. on the size of concentric fluctuations, their characteristic correlation time. The spectrum registration is carried out by an oscilloscope or by XY plotter. The Malvern correlator version is presented in Fig. 1 with its advantage. Some characteristic versions of the device are in Table 1.

The preparation of samples depends to a considerably exent to the specific features. The main principle impurity consists in that the milieu is optically pure. For the case of small molecules, concentrations are made directly by measuring the bases or by adding solvents till definite volume of the standard (~5 cm^3).

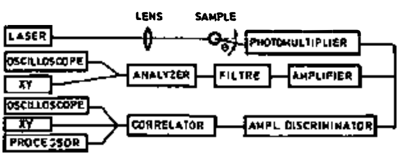

Fig.1 The measuring device

Table 2 The details of SDS measurements

RUN	// TIME //	TOTAL	//DIFF	//SIZE	//POLY	/GAM.1	//GAM.2
31	115337	429108	4.52E-8	1.08E-5	2.76E-1	223	269

(110 measuring points).Through the programmes incorporated we get besides D other characteristics necessary,i.e. the width of the spectra Γ_1 and Γ_2 (beneficial for the cumulant methods) and for the polydispersity assesment. Thereby, the possibility of data interpretations are the "main problem". The data are connected according to Γ_1 only to the concentration correlation function.From PLA measurements is otfen required that the series of measurements do not deviate for more than 5% ("pure material criterium"). The value D=4.665 $10^{-8}cm^2/s$ is obtained and therefore d=1.065 μm.

DMSB IN AQUAL SOLUTION The measurements of DMSB in very big concentration is presented in Fig. 2

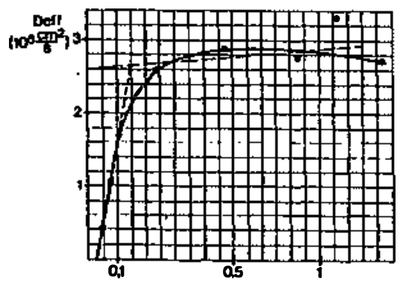

Fig.2 Coefficient of diffusion versus concentration of DMSB

It is shown that the diffusion coefficient changes with concentration in the micellar range. It is much less measured than CTAB and TTAB. CMC (critical micellar concentration is very small about 0.007. It means that the border where D_m(monomers) it is "jumped" in the micellar domain.

The discussion should be extended to D_{1o} (the diluted solution and the big concentration on /8/. It can be connected to the added electrophoretical measurements and DQLS with addition of solts, when those measurements would give their judgements on the interaction potential (DLVO, hard sphere model) and coloidals theory. Stephen model - Corti-Degiorgio model differences are possible and coefficients of the balance monomer-dimers to calculate, too. /8/.

PHYTOL - QUINOLINE The mixture measured in two versions of devices shows primarilly the problems connected to the obtention of optically pure milieu. The problems of concentrics mixtures is uncertain to interprete and is measured with other coupling effects, for "small molecules".

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