is based on the three-variable expansion of the Mori equations [4, 5], adapted to anisotropic systems, where the generalized spherical harmonics are no longer independent variables.

The Fourier transforms $J_{\mathrm{MN}}(\omega)$ of the correlation functions $G_{\mathrm{MN}}(t) = (\delta D^{\mathrm{M}}(t), \delta D^{\mathrm{N}}(\mathrm{o})^{x})$ are found to be:

$$J_{\mathrm{MN}}(\omega) = \sum_{\mathrm{Ki}}\sum X_{\mathrm{Mi}} X_{\mathrm{iK}}^{-1} G_{\mathrm{KN}}(\mathrm{o}) \times$$

$$\times \{\mathrm{i}\omega + \lambda_{\mathrm{i}} K_0 [\mathrm{i}\omega + K_1/(\mathrm{i}\omega + \gamma)]^{-1}\}^{-1}$$

where X and $\{\lambda\}$ are eigenfunctions and eigenvalues of the anisotropic diffusion operator. The expansion parameters K_0, K_1 are related to mean-square angular velocity and (total) torque N, and $1/\gamma$ to the torque relaxation time. The diffusion equation results are recovered under 'strong anisotropic interaction limit' (SAIL) conditions [6], $K_1/K_0 = N/kT >> 1$.

References

1 P. L. Nordio and U. Segre, 'Rotational Dynamics', in *'The Molecular Physics of Liquid Crystals'*, G. W. Gray and G. R. Luckhurst, Eds., Academic Press, London (1979).
2 A. De Vries, *J. Chem. Phys., 71,* 25 (1972).
3 F. Volino, A. J. Dianoux and H. Hervet, *Mol. Cryst. Liq. Cryst., 38,* 25 (1977).
4 D. Kivelson and T. Keyes, *J. Chem. Phys., 57,* 4599 (1972).
5 G. J. Evans and M. W. Evans, *J. Chem. Soc. Faraday II, 73,* 285 (1977).
6 G. Moro and P. L. Nordio, *Chem. Phys., 43,* 303 (1979).

The Effect of Solute Structure on the Nematic–Isotropic Transition in Binary Mixtures

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Systematic thermodynamic and statistical-mechanical studies of nematic–isotropic (NI) phase equilibria in binary mixtures have provided significant information on the effects of molecular size, shape and flexibility on the orientational order and stability of nematic mesophases [1–3].

The addition of solute to a nematogenic solvent either depresses or elevates the NI transition temperature (T_{NI}) of the pure solvent and gives a two-phase region. The phase diagram in the T^*–x_2 plane $T^* = T/T_{\mathrm{NI}}$; x_2 = solute mole fraction) yields coexistence curves that are virtually linear for $x_2 < {\sim}0.10$. Of interest is the negative of the slope of the lower phase-boundary line (nematic/nematic + isotropic), $\beta_{\mathrm{N}} = -(\mathrm{d}T^*/\mathrm{d}x_2)_{\mathrm{N}}$, which is a measure of the order-destroying (positive β_{N}) or order-enhancing (negative β_{N}) ability of a solute.

Experimental β_{N} results are presented for mixtures of quasispherical (tetra-n-alkyl tins), chain-like (n-alkanes) and rodlike (*p*-polyphenyls) solutes dissolved in nematogenic solvents (MBBA and 5CB). These results are compared with the predictions of lattice models, which stress the predominant role of repulsive interactions.

References

1 D. E. Martire, 'The Molecular Physics of Liquid Crystals', G. R. Luckhurst and G. W. Gray, eds., Academic Press, London (1979); chaps. 10 and 11.
2 D. E. Martire and F. Dowell, *J. Chem. Phys., 70,* 5914 (1979), and references therein.
3 G. A. Oweimreen and D. E. Martire, *J. Chem. Phys., 72,* (1980), and references therein.

Properties of Amphiphilic Nematic Systems†

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Nematic liquid crystalline states formed in mixtures of surfactant and water correspond to anisotropic micelle solutions with anisometric surfactant aggregates of a finite size. Addition of salts and co-surfactants stabilize in general the nematic state. An addition of chiral compounds leads to the formation of cholesteric states.

There are two different nematic states and direct transitions between the states are possible. The transition is weakly first order. The temperature dependence of the nematic order parameter can be positive or negative. It differs in general significantly from that found in thermotropic nematics. Curvature elastic and viscous properties seems to be qualitatively the same as in thermotropic nematics. Results on curvature elasticity coefficients obtained on the decylammoniumchloride/NH_4Cl/water system will be discussed and the methods of measurements described.

Incorporation and Transport of Solutes in Lipid Bilayers

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Lipid bilayers are excellent solvents for amphiphatic, hydrophobic and even charged molecules. This property is essential for the role of the lipid bilayer as fundamental building unit of biological membranes where a large class of molecules ranging from small substrates to large enzyme complexes must be organized in well defined structures. This property is closely related to the liquid-crystalline structure and the two-dimensionality of the bilayer. The molecular organization of bilayers and mono-

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layers of lipid mixtures, of lipid–protein alloys and of two-dimensional solutions has been studied by different spectroscopic methods, by neutron scattering and by freeze etch electron microscopy. The molecular transport in the plane of the membrane as well as the exchange of molecules between different lipid lamellae is studied by fluorescence spectroscopic techniques.

As a further point the possibility of specific lipid–protein interactions based on elastic and electrostatic forces is reported. The role of defects in the neighbourhood of proteins or at phase boundaries as attractive centres for small molecules is discussed.

Order Parameters and Orientational Dynamics of Fluorescent Solutes in Anisotropic Fluids

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There have been, in the past, a number of experimental works aimed at determining the orientational order parameters $\langle P_2 \rangle$ and $\langle P_4 \rangle$ of fluorescent solutes by polarization methods [1]. In this communication the problem of the information available in a fluorescence polarization experiment is discussed from a general point of view. The fluorescence intensities are obtained at first as a function of time [2]. While these expressions can be used to interpret time resolved depolarization experiments they can also be used, when integrated over time, to analyze the more common continuous illumination type experiments [1]. The importance of the relative time scales of the fluorescence decay and reorientation processes is discussed.

The treatment is extended to angular dependent experiments where the polarizer on the incoming or outcoming beam or the director [3] are rotated.

References

1 G. Baur, A. Stiel and G. Meier, *Mol. Cryst. Liq. Cryst., 22,* 261 (1973); I. N. Dozov and I. I. Penchev, *Acta Pys. Pol., A54,* 649 (1978); V. K. Dolganov and B. M. Bolotin, *Mol. Cryst. Liq. Cryst., 47,* 179 (1978).
2 C. Zannoni, *Mol. Phys., 38,* 1813 (1975).
3 S. Sakagami, A. Takase, M. Nakamizo and H. Kakiyama, *Bull. Chem. Soc. Jap., 46,* 2062 (1976).