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Preface

Thermodynamic and structural characterization of liquid crystalline systems has been of ongoing scientific interest since decades. Recently, interest has focused towards the field of biological systems, especially to the study of membranes and their structures. Since they are rather compex systems, thus have been mainly investigated by using simple model membranes. This has resulted in interdisciplinary studies bringing together biologists, biochemists, physicists and colloidal chemists. Besides of gaining a wealth of knowledge on the self-association of amphiphilic molecules information on the properties of biological systems have been obtained. These preliminaries gave the idea to the Guest Editors to collect a set of papers and pubish them as a special chapter of the Journal of Thermal Analysis and Calorimetry.

Therefore, a number of contributions deal with the mixing behaviour of phospholipids, the building blocks of the membrane bilayer. Their intrinsic molecular interactions can be deduced from the shape of the phase diagram constructed from the analysis of heat capacity curves obtained by differential scanning calorimetry (DSC). A procedure for the simulation of these curves based on regular solution theory is presented and the concentration dependent effects of additives on binary phospholipid mixtures mimicking biological membranes are described. Furthermore, it is shown that information concerning the self-organization of molecules can be obtained by isothermal titration calorimetry (ITC). A complete thermodynamic description of these systems gives insights into the formation and stability of colloidal systems. Exemplary, the influence of the chemical nature of amphiphilic molecules will be shown on hand of glycolipids and how their different thermotropic mesophases influence the formation of lyotropic aggregates near the critical micelle concentration. Further examples on lyotropic liquid crystals and microemulsions for pharmaceutical use and the binding process of amphiphilic molecules to biocompatible polymer and its consequences will be also given. Another contribution shows the effect of steady state and shear stress conditions on the thermotropic behaviour of amphiphiles. Thermotropic liquid crystals are also presented in this chapter. Studies on ferroelectric liquid crystals as well as on ferronematic liquid crystal systems emphasize the importance of DSC in understanding these systems that are of potential interest in material sciences. Finally, DSC has been shown to be beneficial for process controlling in manufacturing and consequently product quality as described for water/oil/water multiple emulsions that may be used for sustained, controlled drug delivery systems. The last two articles of this issue underline the use of DSC and ITC measurements in food technology such as the development of improved dairy products.

The articles of this issue should show the reader the importance of thermodynamic studies combined with structural techniques such as X-ray scattering, electron and polarized light microscopy in the characterization of liquid crystalline-like structures, which are of relevance for both biological systems and industrial applications. With the representation of thermotropic and lyotropic systems we have intended to shed light on the mutual advantage of studying these systems, which has resulted in the enlargement of our knowledge and has opened new perspectives in the interpretation of several phenomena of self-organized liquid crystalline systems.

Guest Editors

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