22.1-4   LYOTROPIC CUBIC PHASES. By S.T. Hyde, Department Applied Mathematics, Australian National University, Canberra.

Infinite periodic surfaces of constant average curvature (IPHS) are proposed to represent many interfacial structures in cubic phases of surfactant/water/oil systems. Unfortunately very few such surfaces are known.

A construction procedure, using suitable stereohedra permits generation of IPHS of any symmetry. It turns out that many IPHS exist within a single space group, and various topologies occur.

The symmetry of the liquid crystal can be determined by conventional methods, but assignment of structure is impossible without topological information.

By combining X-ray and neutron data on the surface area with molecular packing constraints (surfactant molecule volume, head group area and tail length), the topology of the interfacial structure can be determined via a parallel surface construction.

This is sufficient for the detailed geometry of the cubic phase to be determined unequivocally.

22.2-1   A RELATION BETWEEN X-RAY FOUND LIQUID STRUCTURE AND PACKING COEFFICIENT. By A. Mikusińska-Planner, Institute of Physics, A. Mickiewicz University, Poznań, Poland.

The value of packing coefficient was proposed to be the basic criterion of correctness of the X-ray experimentally found liquid structure. The value of k was estimated from the specific volume of the molecule V_0 and the number of molecules n in an elementary pseudocell of the spherical volume V. The appropriate data for liquid 2-methylpropanol-1 and 2-methylpropanol-2 are given in the Table.

Alcohol	$V_0 [\text{Å}^3]$	$V [\text{Å}^3]$	n	k
2-methylpropanol-1	82.4	759.5	5.0	0.55
2-methylpropanol-2	116.5	775.7	3.6	0.54

The value k=0.55 confirms the chain structure of associates of the liquid 2-methylpropanol-1 as it falls within $0.51 \leqslant k \leqslant 0.58$ corresponding to the liquid phase. The value k=0.54 corresponds to the structure of liquid 2-methylpropanol-2 which admits the coexistence of dimers and trimers (A. Mikusińska-Planner, J. Mol. Liquids, 1986, 31, 203-212). Assumption of chain structure of 2-methylpropanol-2 associates leads to k > 0.58 which is not allowed for liquids.

22.3-1   HIGH RESOLUTION ELECTRON MICROSCOPY OF SEMIAMORPHOUS MATERIALS. By B.K. Moss, J.D. McLean, P. Goodman, CSIRO, Division of Materials Science and Technology, Locked Bag 33, Clayton, Australia 3168 and R.W. Truss, ICI Central Research Laboratories, Ascot Vale, Australia 3032.

The image interpretation of amorphous and semiamorphous materials is different from the situation with crystalline materials, except for extremely thin films. The random structure causes the loss of phase relationships for interference between wave fronts as the electron beam is transmitted through a moderate thickness. At a certain thickness any information concerning the upper regions of the sample will be lost and eventually, at a certain thickness, all sharply-imaged detail will arise from close to the lower surface. This phenomenon has been described in the past in reference to crystals as a "top-bottom" effect (e.g., Smith, D.J. and Cowley, J.M., Ultramicroscopy, 1975, 1, 127-136).

The structure of bulk industrial grade polyvinyl chloride (PVC) has been studied. Sections, prepared by a special technique involving a cross-linked albumen (McLean, D.J. and Singer, S.J., Proc. Nat. Acad. Sci., 1970, 65, 122-128), approximately 100 nm. thick, were found to yield detailed structure images. It is believed that this technique will have more general application.

From the specific investigation of PVC we confirm from real space studies the existence of two distinct forms, corresponding to the 'random coil' model of disassociated linear chains and to a micelle model containing regions of 2- or 3- dimensional crystallites. B.K.M. acknowledges the support of a CSIRO Postdoctoral Fellowship.

22.4-1   CALCULATION OF SMALL-ANGLE SCATTERING FROM MODEL STRUCTURES FOR SURFACTANT SYSTEMS. By Ian S. Barnes, Department of Applied Mathematics, Australian National University, Canberra.

A method is presented for calculating the small-angle X-ray or neutron scattering from arbitrary structural models for surfactant systems. This allows the first comparison of theory with experiment for model structures other than those few which permit analytical calculation.

The model structure is sampled on a cubic lattice, and assumed to have constant scattering length density in each small cubic region of the lattice. The scattering from this digitized structure is then calculated by three-dimensional numerical Fourier transformation, squaring and averaging over directions in Fourier space.

This technique has been used in the study of the oil-rich microemulsion which exists over a large range of composition in the DDAB/water/cyclohexane system. The variation of conductivity with water fraction is at odds with existing models. A new model is proposed for microemulsion structure: the Disordered Open Connected (DOC) model. This is a random network of water-filled cylinders with spheres at the points of intersection. As water is added, the co-ordination of the network decreases, with a percolation to isolated spheres giving the observed conductivity variation. It is hoped to refine the model by replacing the spheres and cylinders with a surface of constant mean curvature.

Comparison of the experimental and calculated scattering curves for a particular sample at low water content confirms our rejection of the existing models. The calculated curve for the DOC model agrees well with the experiment.