ELSEVIER

Chemical Engineering Journal 66 (1997) 84

CHEMICAL ENGINEERING JOURNAL

Book Review

Polyelectrolytes – Formation, Characterisation and Application

by H. Dautzenberg, W. Jaeger, J. Kötz, B. Phillipp, Ch. Seidel and D. Stscherbina, ISBN 3 446 17127 4, published by Hanser, Munich, 1994, Hardcover DM 168/$98.50, 360 pp.

This multi-disciplinary, multi-authored book on polyelectrolytes (PELs) covers their synthesis (or sources), theoretical modelling, electrochemical and spectroscopic characterisation, solution behaviour, interaction with other electrolytes and finally applications in a wide and diverse field. It is, therefore, a self-contained text book, intended for graduate teaching in polymer physics and chemistry as well as a support text in engineering and life science courses and research dealing with polymers, colloids and interfaces.

Polyelectrolytes consist of a macromolecular ion (macroion) with low molar mass counter ions by virtue of which such macromolecules become water soluble. However, due to the existence of the macromolecular backbone, they also show the characteristics of polymers. Furthermore, because both hydrophobic and hydrophylic moieties are present on the same molecule, such macromolecules also exhibit surface activity. This brief description explains the complexity of their behaviour and their wide range of applications.

The book consists of 8 chapters, the first two of which deal with the description, synthesis and chemical modification of PELs. Chapters 3 and 4 describe the solution dynamics of dilute PEL solutions and their potentiometric, conductometric, polarographic, electrophoretic and spectroscopic (NMR and UV/VIS) characterisation. Chapter 5 deals with the characterisation of macromolecular parameters in solutions by osmometry, static and dynamic radiation (light, X-ray and neutron) scattering techniques as well as flow-based techniques such as viscometry, sedimentation and chromatography.

Unlike surfactants, liquid crystal structures in PELs are absent due to the large variations in the molecular dimensions and architecture. Nevertheless, PELs can form identifiable structures as a result of intra- or inter-molecular effects mainly based on electrostatic forces. Therefore, these structures (i.e. aggregates, flocks and adsorbed layers) are dependent on the electrolytic conditions. Chapter 6 examines the background to structure formation which is important in the application of PELs as outlined in Chapter 7. These applications range from the solubilisation, phase separation, viscosity modification in dispersions, interface modification in coatings and adhesives, controlled release membranes (mainly pH dependent) and flocculation. The final chapter contains conclusions and a prognosis.

Although the book is intended as a text book, it contains up-to-date references numbering nearly a thousand. The (chemical) engineering aspects of PELs have not been treated even though such macromolecules are also important in enhanced oil recovery and the rheology of concentrated dispersions which yield very interesting flow phenomena. Furthermore, the book does not mention some novel applications based on the tailoring of molecular architecture which allows the incorporation of such molecules into liquid crystal structures. However, these are minor points. The book is a very useful, highly readable contribution to the physics and chemistry of polyelectrolytes. I can also recommend it to research students in chemical engineering, materials science and life sciences as background reading if they deal with colloidal and interfacial effects.

G. Akay
Department of Chemical Engineering
University of Nottingham, UK