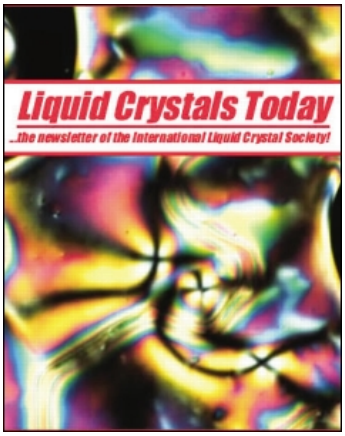

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Polarized Light in Liquid Crystals and Polymers

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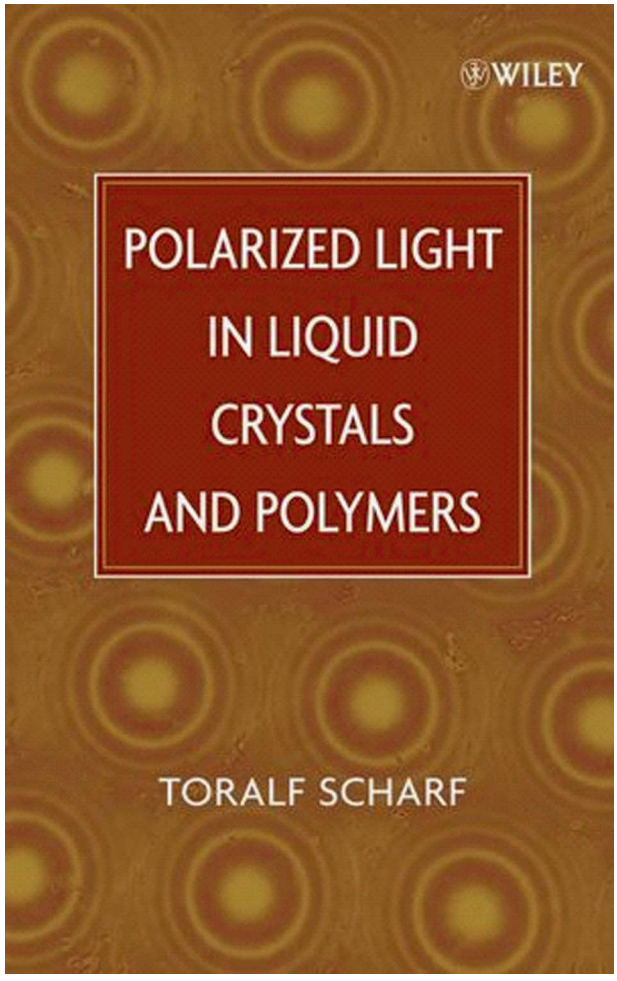
Book Review

Polarized Light in Liquid Crystals and Polymers, by Toralf Scharf, Wiley, 2006, 400 pp., (hardback), ISBN: 0-471-74064-0



The majority of people working in the field of liquid crystals will at some stage be required to consider the interaction of light with such materials in some way. Whether this is for the identification of liquid crystal phases, analysing the quality of thin films or for modelling more technologically based display applications, an understanding of the optical properties of such materials is vital. It is therefore surprising that suitable texts that comprehensively cover the theoretical and practical aspects of liquid crystal optics are rather rare. *Polarized Light in Liquid Crystals and Polymers* by Toralf Scharf more than adequately fills this gap in the market and should be considered as essential reading for any postgraduate student embarking on the study of liquid crystals. In addition, the readily accessible index makes this book a valuable reference text for those already established in the field.

The book is divided into 11 chapters covering physical optics (and associated modelling methods), basic properties of liquid crystals, microscopy and liquid crystal based optical elements. Each chapter is accompanied by numerous references to relevant and up-to-date papers as well as publications considered as 'classics' in the field.

The first five chapters, constituting around a quarter of the book, are devoted to general optics in anisotropic media. The book starts with a basic introduction to the mathematical description of polarised light before moving on to topics such as the behaviour of electromagnetic waves in anisotropic media, ray optics and multi-layered birefringent media. In each case, full mathematical derivations are given requiring only a rudimentary knowledge of optical physics. The understanding of a novice in the field is also greatly enhanced by numerous diagrams and illustrations to highlight specific examples such as the orientation of index ellipsoids with respect to interfaces and planes of incidence. From this general introduction the book then moves on to focus specifically on liquid crystals and, to a lesser extent, polymers. The introduction to the fundamental physical properties of liquid crystals and their various phases does not occur until Chapter 6 and is standard fare. However, the inclusion of specific details about the properties of several different pure and compound commercial materials commonly used in the laboratory adds a new degree of relevance to these discussions.

Chapter 7 is a rather technical chapter on polarisation microscopy of liquid crystals. The inclusion of large amounts of technical detail on the operation of a standard microscope at times appears rather laboured, and is not essential for the understanding of the remainder of the book. However, the subject is in-keeping with the idea of the book being a comprehensive text on liquid crystal optics and does lead on

well to the subsequent chapter on liquid crystal textures. Numerous microscope images of nematic and smectic textures and associated model director structures are given. Attention is also paid to electrically induced phenomena such as fringing fields in pixels and the effects on the resolution limit of switchable liquid crystal devices.

A more detailed discussion of the manufacture and operation of liquid crystal based optical elements is given in Chapters 9 and 10 such as liquid crystal phase shifters, electrically switchable microlenses and electrically switchable gratings. The final chapter of the book is devoted to Bragg diffraction and the optical effects of cholesteric liquid crystals.

In summary, this book clearly achieves what it sets out to do from the title and covers all of the major topics in optics that one might expect to encounter in the laboratory. The book stands out because it is specifically written with the liquid crystal enthusiast in mind, rather than being a standard optics text with a diversion on liquid crystals 'bolted on'. My one minor criticism that may be levelled at the text as a whole is the use of short, staccato sentences throughout the book. I personally found that this writing style made reading the text quite tiring and at times hindered the flow of the descriptions being offered. However, this in no way detracts from the valuable content of the book which I highly recommend and should be considered as essential reading for anyone embarking on research in the field of liquid crystals.

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