Crystals that flow

T.J. Sluckin, D. A. Dunmur and H. Stegemeyer

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Book Review by

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Liquid crystals correspond to a state of matter with properties that are typical of the apparently antithetical liquid and crystalline states. Thus they do flow, as the title of this book suggests, and at the same time have the optical anisotropy that we normally associate with solid crystals.

The book recounts the history of this fascinating state of matter from its discovery in 1888 to date through a compilation of 45 landmark articles, very usefully translated into English, when necessary, from the French, German or Russian originals.

The book is organized in five sections: (A) the early period, (B) the interwar period, (C) the modern physical picture, (D) the development of liquid crystal display technology, (E) lyotropic and polymeric liquid crystals. Each of this sections is knowledgeably and wittily commented by the authors, Tim Sluckin, David Dunmur and Horst Stegemeyer, placing the papers in their historical context and in perspective.

The articles are sometimes abridged, with the book authors' comments included. It is a pleasure to see that each article is accompanied by a short biography of each of the authors. This is in itself worthwhile in our anonymous times and makes it clear that the authors and their papers are drawn from the quite different areas of Chemistry, Physics, Mathematics and Technology, showing the truly interdisciplinary nature of the liquid crystal field.

The book will make delightful reading for any researcher working on liquid crystals, but should be, for various reasons, more generally of value to anyone with an interest in the history of science.

For one the history of liquid crystals, differently from that of many other scientific endeavors, astronomy for example, is all comprised in a short time span where means of documentation, like the photographs of the authors that adorn the book, could be recorded, together with detailed accounts of its development.

Secondly, the history of liquid crystals is in many ways telling of the initial development of other fields and it can be instructive for those that view science as a step by step purely incremental process to see that the development of liquid crystals, like that of most other subjects is also one of violent controversies.

The strong opposition to the very concept of a "liquid crystal" displayed by the eminent Prof. Tammann and others is well illustrated in Section A of the book, as is the fight for priority between Reinitzer, the first discoverer of liquid crystals, and Lehmann who actually demonstrated their existence and performed their characterization. It is curious that Lehmann himself, however, had a quite incorrect view of the forces causing the existence of liquid crystals, as he believed in a special kind of structural intermolecular forces, a *Gestaltungskraft.*

When the existence of liquid crystals was finally accepted, another period of controversy, well accounted for in Section B, followed between the *swarm theory* of Bose, Ornstein and Kast, based on discrete discontinuous domains, and the theory of Oseen and Zocher, which proved to be the winning one, based on a continuous distortion of a *director field*.

The papers in Section C with, amongst others, the great contributions by Zwetkoff, Maier and Saupe, Frank, de Gennes and the introduction of order parameters, molecular field theory, elasticity, leads directly to the theoretical and interpretative tools now currently used.

It is worth noting that the history of liquid crystals as emerging from the book seems to be mainly the result of individual or anyway of small group efforts. It is amazing to se the effect that this small science, so different from that of the huge groups at work in particle physics and many other subjects, has had not only on our fundamental understanding of condensed matter but also on society at wide, as proved at least by the fact that most people nowadays carry around a liquid crystal sample in their mobile phone display. The road leading to technological applications in displays is covered in Section D with reprints of key contributions, e.g. by Schadt and Helfrich, Gray, Meyer, Clark and Lagerwall as well as of significant patents.

The last section, touches on Lyotropic and Polymeric systems, that could of course justify a volume of their own. The coverage cannot be as extensive as that of thermotropics but the basic theoretical papers still quoted today of Onsager, Flory and the landmark papers of the seventies by Roviello and Sirigu and by Finkelmann, Ringsdorf and Wendorff on liquid crystalline polymers are reproduced.

In summary this is a fascinating book, that could be well find its place on every liquid crystal scientist personal library, were it not for the, perhaps inevitably, high price. It would be nice to have an economical paperback edition to favor the diffusion that the book and its authors deserve.

Lyotropic, Polymeric and Elastomeric Liquid Crystals.Â @inproceedings{Stegemeyer2004CrystalsTF, title={Crystals that flow : classic papers from the history of liquid crystals}, author={Horst Stegemeyer and Timothy J. Sluckin and David A. Dunmur}, year={2004} }. Horst Stegemeyer, Timothy J. Sluckin, David A. Dunmur. Published 2004. Crystals that Flow is aimed at liquid crystal scientists- from whatever background- physics, mathematics, chemistry, engineering or computer science. Historians of science will also find this a useful reference. Table of Contents. A veritable crystal dictionary, this guide enables readers to reveal their life paths and hidden 101 Power Crystals: The Ultimate Guide to Magical Crystals, Gems, and Stones for Healing. 547 PagesÂ·2011Â·17.82 MBÂ·10,243 DownloadsÂ·New! , it is no wonder crystals have always been regarded as a source of power from ancient times to present da New Visions of Isaiah. 345 PagesÂ·1996Â·17.14 MBÂ·5,592 DownloadsÂ·New!

Get 3 examples of modeling photonic crystals in COMSOL MultiphysicsÂ®, including a GaAs pillar, fiber, and band gap structure.Â To model this photonic crystal in the COMSOL MultiphysicsÂ® software and add-on Wave Optics Module, the transverse electric (TE) wave (polarized in the z direction) is made to propagate through the left boundary using the Scattering boundary condition and an amplitude of 1 V/m. The rest of the boundaries are assigned Scattering boundary conditions with no incident fields. Liquid crystal phases have a range of different structures, but all have one thing in common: they flow similarly to viscous liquids, but show the physical behavior of crystals. Share Icons revealed to the left. A crystal that flows? After over 120 years of research in liquid crystals, a large number of liquid crystal phases have been discovered. Liquid crystal phases have a range of different structures, but all have one thing in common: they flow in a similar way to viscous liquids, but show the physical behavior of crystals. Crystals that Flow is aimed at liquid crystal scientists- from whatever background- physics, mathematics, chemistry, engineering or computer science. Historians of science will also find this a useful reference. Table of contents.