

Liquid Crystal Dimers

Santanu Kumar Pal | Sandeep Kumar

Liquid Crystal Dimers

Santanu Kumar Pal
Sandeep Kumar

 CAMBRIDGE
UNIVERSITY PRESS

58585

CAMBRIDGE UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom
One Liberty Plaza, 20th Floor, New York, NY 10006, USA
477 Williamstown Road, Port Melbourne, vic 3207, Australia
4843/24, 2nd Floor, Ansari Road, Daryaganj, Delhi – 110002, India
79 Anson Road, #06–04/06, Singapore 079906

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning and research at the highest international levels of excellence.

www.cambridge.org

Information on this title: www.cambridge.org/9781107157590

© Santanu Kumar Pal and Sandeep Kumar 2017

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2017

Printed in India by Magic International Pvt. Ltd., Greater Noida

A catalogue record for this publication is available from the British Library

Library of Congress Cataloging-in-Publication Data

Names: Pal, Santanu Kumar, 1981- author. | Kumar, Sandeep, 1959- author.

Title: Liquid crystal dimers / Santanu Kumar Pal, Sandeep Kumar.

Description: Daryaganj, Delhi, India : Cambridge University Press, 2017. |

Includes bibliographical references and index.

Identifiers: LCCN 2016054803 | ISBN 9781107157590 (hardback ; alk. paper) |

ISBN 1107157595 (hardback ; alk. paper)

Subjects: LCSH: Liquid crystals. | Dimers. | Polymer liquid crystals.

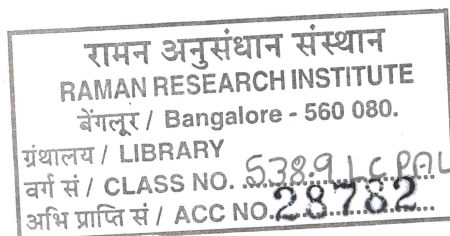
Classification: LCC QD923 .P35 2017 | DDC 621.3815/422--dc23 LC record available at

<https://lccn.loc.gov/2016054803>

ISBN 978-1-107-15759-0 Hardback

Additional resources for this publication at www.cambridge.org/9781107157590

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.



Contents

Preface	<i>ix</i>
Acknowledgements	<i>xi</i>
1. Introduction	1
1.1 Liquid Crystals	1
1.2 LC Dimers	2
1.3 Classification of LC Dimers	2
1.4 Calamitic Dimers	2
1.5 Discotic Dimers	5
1.6 Bent-Core Dimers	7
2. Calamitic–Calamitic LC Dimers	10
2.1 Introduction	10
2.2 Linear LC dimers	11
2.3 H-Shaped LC Dimers	26
2.4 T-Shaped LC Dimers	37
2.5 T-Shaped Chiral Dimers	46
2.6 U-Shaped LC Dimers	46
2.7 O-Shaped LC Dimers	51
3. Calamitic–Cholesteric LC Dimers	59
3.1 Introduction	59
3.2 Structure–Property Relationship of Cholesteric Dimers	60
4. Discotic LC Dimers	118
4.1 Discotic–Discotic LC Dimers	118
4.2 Discotic–Calamitic LC Dimers	169

5. Bent-Core LC Dimers	185
5.1 Symmetrical Bent-Core LC Dimers	185
5.2 Nonsymmetrical Bent-Core LC Dimers	201
5.3 Unconventional Bent-Core LC Dimers	219
6. Perspectives	225
6.1 Photoresponsive Cholesteric Dimers for Rewritable Recording Materials	225
6.2 Discotic Dimers as Dopants for LC Display (LCD) Mixtures	227
6.3 Discotic Dimers as Organic Light-Emitting Diodes (OLEDs)	228
6.4 Bent-Core Dimers for Display Devices	229
6.5 Bent-Core Dimers for Conducting Molecular Wires	229
6.6 Bent-Core Dimers for Photo-responsive Functional Systems	229
<i>Index</i>	233

Liquid crystal (LC) dimers are formed by connecting two mesogenic cores through flexible spacers. They are soft materials that exhibit unique functionality of combining both order and mobility at a molecular, supramolecular and macroscopic level. Although a lot of research is happening in this area, there is a lack of material available on the basic design principles, transitional properties, device fabrication and applications of dimeric LCs. This book comprehensively discusses the design principles, synthesis and thermal behaviour of all types of LC dimers. Besides fundamental concepts, it also discusses the recent advances in the field of calamitic, discotic and bent-core dimeric mesogens.

Beginning with a chapter on the introduction of LC dimers, odd-even behaviour, basic classification and most common mesophases in dimers, it focuses on the usage of LC dimers in developing new materials to study a range of interesting phenomena such as formation of biaxial nematic phase containing rod-like and disc-like mesogenic units. It also covers transitional properties, molecular field theories of dimers, the dielectric, conductivity studies, modelling and simulation, fabrication and testing of display and electro-optic devices of several LC dimers in detail. The book also presents technological relevance of LC dimers including dopants in LC display mixtures exhibiting faster relaxation time and strong flexoelectric coupling.

Santanu Kumar Pal is Associate Professor in the Department of Chemical Sciences, Indian Institute of Science Education and Research Mohali (IISERM), India. His research interests include design, synthesis and characterization of soft materials, LC based biosensors and nanoparticles in LCs.

Sandeep Kumar is Professor in Soft Condensed Matter Group at Raman Research Institute, Bangalore, India. His areas of research include design, synthesis and applications of various liquid crystalline materials.

CAMBRIDGE
UNIVERSITY PRESS
www.cambridge.org

ISBN 978-1-107-15759-0



9 781107 157590