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Liquid Crystals-A Functional Material with New Challenges

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FOREWORD

Liquid Crystals—A Functional Material with New Challenges

The discovery of liquid crystals serves as an excellent example of a success story resulting from interdisciplinary research collaboration and, perhaps more importantly, a collaboration between researchers of two different countries. More than a hundred years ago two scientists, Friedrich Reinitzer from Prague and Otto Lehmann of the Technische Hochschule, Aachen, Germany collaborated, leading to the discovery of liquid crystals. Interestingly, Lehmann was a physicist, in today's terminology a metallurgist or a materials scientist who had invented the hot-stage for an optical microscope to study crystallization and the dendritic growth of solids. Reinitzer was a botanist who was studying the role of cholesterol in plants. The melding of two distinctly different scientific expertise was key to the discovery of a new class of materials, known as liquid crystals.

During the following sixty or seventy years, the work on liquid crystals moved rather slowly, although several syntheses and phenomenological observations were reported during the period. In 1963, the first applications of liquid crystals were reported by Williams and Heilmeier, of the David Sarnoff Research Center (RCA). This report stimulated the interest of Sarnoff, a leading entrepreneur, who had envisioned the potential application of liquid crystal displays (LCD) as flat panels to replace television screens. However, not until 1965 did the scientific community get a full exposure to this new class of material at an international conference at Kent State University.

My first exposure to this material was in 1965, when a starry-eyed engineer/businessman, who had just returned from the conference, visited several of us in Pittsburgh seeking new ideas for commercialization. He wanted to build a doll house with liquid crystal windows which could be switched on or off for transparency. Totally new to this class of materials, my first reaction was that the term "liquid crystal" is an oxymoron like "polywater" or "ferromagnetic polymer," or according to the views of some, the topic of "cold fusion". Until that exposure at Kent State

University, most of us knew of no crystals which were not solid and no liquid which was not completely disordered.

Following the mid sixties, research moved at a much faster pace, primarily due to visible commercial interests. The list of consumer goods which uses LCDs is well in excess of fifty, and growing every year.

The field is not without many research challenges and technological opportunities. We need to improve our understanding of: (1) properties of LC as we go to smaller and smaller dimensions; (2) behavior of liquid crystal blends; (3) new materials synthesis which mimics the behavior of liquid crystals; and (4) use of LC for nonlinear optics, IR sensors, etc.

These are but a few examples of the many challenges which undoubtedly are the topics of discussion at this conference. This conference, dealing with the emerging science and engineering on liquid crystals and supramolecular order, cosponsored by our two countries under the auspices of the Indo/US S&T initiative, is indeed a timely event to celebrate the 50th anniversary of the Office of Naval Research (ONR). Fifty years ago, on 1 August 1946, President Truman signed Public Law 588 (passed by the seventy-ninth Congress of the United States), a first for the US government, to establish the Office of Naval Research to plan, foster, and encourage scientific research. Since then, ONR has maintained offices in London and Tokyo to enhance global collaborations in science and technology.

The success of this conference is solely due to the two principal organizers, Dr. Chandrasekhar, of the Centre Liquid Crystal Research, and Dr. Shashidhar, of the Naval Research Laboratory. In addition to a number of individuals from both our countries who have put this conference together, we recognize Ms. Lakshmi Kinger, of the Science Office of the US Embassy, whose unrelenting efforts and dedication has significantly contributed to the success of the conference.

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