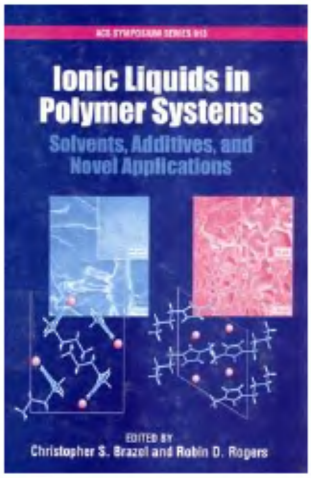

Ionic Liquids in Polymer Systems. Christopher S. Brazel and Robin D. Rogers (eds). ACS Symposium Series 913, American Chemical Society, Washington DC, pp. 206.

In recent times Ionic Liquids (IL) in the field of chemical sciences is drawing attention in many ways especially with the graduation of mindset of researchers towards green chemistry. Liquid crystal was the catchy term probably in the late seventies in the field of modern materials science. Likewise, IL is emerging as a class of chemicals and they already have consolidated their status to offer new scope of applications in chemical science; and that can be understood from this book which is basically a montage of 12 articles along with a subject index at the end.

IL have many attractive attributes like non-volatility, non-flammability, high ionic conductivity, thermal stability, miscibility to a wide range of chemicals of diverse polarities besides a wide potential window and have attracted the attention of chemists and chemical engineers alike. In fact, IL have been brought to the forefront of technology mainly for their role in the chemical process to replace volatile organic compounds (VOC) and solvents to help conserve the ecosystem. Although IL is known to be used mostly for the purpose of synthesis and extraction of small molecules; their application in polymer parlance is at present very marginal even though there is enormous scope. The book under review will be particularly interesting to readers who need to gather new knowledge for research in the area of IL in polymer systems.

The term IL is sometimes appears to be a misnomer as IL is not necessarily always liquid at room temperature but is actually liquid during the reaction process. Because of such a special feature, sometime IL whose physical state is liquid at room temperature is separately designated as RTILs in chapter 8 where information on ion-gel as highly conductive polymer (~10^2 S) electrolytes was shown to have been realized through vinyl polymerization in RTILs. This reminds readers that extended conjugation in organics is not always the only way to achieve conductivity but look for the route of ion-gel to realize high conductivity coupled with processability. Besides such ion-gel, a separate report on the scope of zwitterionic liquids (ZILs) is important to understand the problem of component-ion migration in ordinary IL. Although a host of IL can be seen in different chapters in this book, most of the information is based on imidazole salts. A two-page list of IL showing availability of a wide range of IL with melting points varying from as high as 188°C to as low as –14°C (p. 40, 41) will be useful for experimentalists while selecting their IL vis-à-vis reaction temperature. However, quite a few interesting structures of representative monomers and IL are depicted without mentioning any nomenclature (p. 135), which may make it difficult to visualize the structures readily.

An important feature that can be noted in chapter 2 is that IL may have a special enabling role to make synthesis happen by bringing even hydrophobic and hydrophilic monomers together in a common reaction medium. This may be useful to synthesize copolymers from monomers of diverse polarities. Feasibility to use water-soluble IL as efficient reaction media for polymerization as indicated in chapter 3 is useful in industry from the green chemistry point of view as it shows how water can replace otherwise toxic organic solvents; and this may be of interest to new entrepreneurs for whom it is mandatory and get easy clearance from the regulatory board of environment. In this chapter, there is ample scope for various such polymerization schemes as well.

Further, the role and scope of IL on bio-renewable resources is unique as described in an article that IL can dissolve many water-insoluble materials (chapter 5) including cellulose to provide a methodology to entrap many metals and desired items into the cellulose matrix system with a high degree of dispersion to even in the nanoscale level for realization of nanocomposites towards creation of catalysts and smart materials. Discussion on a set of gel based on nanotubes and IL is useful to understand the nature of soft composite materials. A novel approach in this book p. 163, for example, the use of a polymerizable IL as gelling medium can be a useful method to generate composite material of electroconductive polymer and nanotubes to ensure a more improved dynamic hardness as a result of strong connectivity at the interface, may stimulate researchers towards innovation.

Yet another scope of application is the role of IL as porogene while cross-linking monomers like divinyl benzene and vinyl pyridine system to prepare polymer-IL composites as reported in an article (p. 133) where analyses of BET, SEM, besides highlighting the result of solid-state NMR to reveal higher degree of cross-linking compared to that in the presence of usual solvents like toluene are important indeed. Readers will also find yet another novelty of IL based on ammonium, imidazolium and phosphonium cations as alternative plasticizers for polyvinyl chloride (PVC) to realize an additional advantage of the low solid–solid migration as a result of the mutual preference of cations for anions and vice versa within the matrix system.

A brief elucidation on atom transfer radical polymerization (ATRP) and reverse-ATRP in chapter 4 helps in understanding these two relatively newly emerged polymerization mechanisms where, more importantly, it emphasized the scope of IL in reducing the requirement of the amount of metal catalyst unlike otherwise required for usual reverse-ATRP.

Interestingly, chiral IL are also reported to show that molecular weight distribution of polymer could be much wider if the polymerization was carried out in absence of IL. It has also highlighted that asymmetric environments of IL could exert some influence on stereo-structure of the polymers to achieve isotacticity with narrow polydispersity.

There is a report on rubbery gel with reversible shrink-swelling feature achieved through cross-linking of functionalized polyethylene glycol in the presence of IL and another on the application of imidazolium-based IL to increase the

galleries of the clay like montmorrillonite to a greater extent than usual surfactants.

Without doubt, this book is a fruition of outstanding effort of collation of precious articles of interest to polymer chemists. However, mistakes are found in terms of misprinting as well as deficiencies in sentence construction, missing words besides nonuniformity in typographical format. For example, the sentence 'Plasticized PMMA samples were polymerized in the presence of plasticizer' (p. 108) is technically incorrect as PMMA is already a polymerized form of methylmethacrylate (MMA).

The acronyms used in the book leaves much to be desired. For instance, there is discussion on LiTFSI (p. 89) but its chemical name is missing in the book. This should necessarily have been mentioned earlier as lithium salt of trifluorosulphonimide. Similarly, AGM (p. 79) may not be understandable by many readers as nowhere in the book its full form is mentioned. One presumes AGM is meant to be alternate gradient magnetometer if it is not a misprint for AFM. Details of the experiments on thermal analyses in chapters 7 and 10 should have been brief yet explicit as one would expect from such a specialized book.

In all fairness to the authors, the reviewer concludes by saying that this book sparkles with substance of worthy information. In all probability its slimness implicates the significance of quality over quantity.

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Science in Denmark – A Thousand-Year History. Helge Kragh, Peter C. Kjaergaard, Henry Nielsen, Kristian Hvidtfelt Nielsen (eds). Aarhus University Press, Langelandsgade 177, DK-8200, Aarhus. 2008, pp. 607. Price: EUR 66.95.

Science in Denmark reminds the Indian readers about *A Concise History of Science in India* edited by D. M. Bose, S. N. Sen and B. V. Subbyrayappa. The preface of *Science in Denmark* says that it is a short version of the *Dansk Naturvidenskabs Historie*. The major objective is to present the history of Danish science in the cultural, social and political context. 'The word "Danish", mainly refers to the scientific activities that took place within the varying boundaries of the Danish (or Danish–Norwegian) Kingdom, such as they were at any given time' (p. 13). Whereas science is taken in a much broader context, which includes alchemy, phrenology, etc. (p. 14). The book has been divided into four parts; each of which contains six chapters. In the end, an epilogue and an intensive list of references are given.

Part I covers the time period from 1000 to 1730 and is titled 'From medieval scholarship to new science'. While there cannot be Danish history without vikings, not surprisingly, the book starts with the chapter 'From viking age to absolute monarchy'. There is no romantic view of a prototype viking and his journeys as presented in films and literature. One of the authors Helge Kragh briefly mentions the discovered golden horns of viking, which supposedly give evidences of astronomical and astrological knowledge of the time. The chapter covers diverse topics such as the influence of the Lutheran religion on science, the financial support of science by Noblemen and Kings, the foundation of the University of Copenhagen, introduction of printed books and some of the Danish scholars.

In chapter 2 on page 26 we learn that 'throughout the 1200s Denmark gradually evolved from a peripheral and rather barbaric country into an integrated part of European culture, based on Christianity and the Latin literature'. In the late 1200s Denmark had a few hundred 'learned' people, who had command over Latin – the language of scholars. The tradition of printing of books came quite late. Until 1550 or so the annual book production was limited to three to four titles (p. 29). Due to lack of universities at home, many Danes went to France, Germany and England for higher education. Nordic regions had to wait for such a structure until 1400s. Chapter 3, 'Institutions travel and literature' describes the establishment of the Soroe Academy and University, Tycho Brahe's Observatory, Round Tower Observatory and Museum Wormianum. In the second half of 1600s about 1400 titles were published, roughly half in Latin (p. 53). The famous astronomer Tycho Brahe was the first to build a paper mill in Scandinavia. As far as scientific journals were concerned, *Acta medica* (1673–1680) was the first title. The chapter 'The religious dimension' focuses on interrelations among church, state and educational institutions. The influence of these authorities has been stated as follows: 'Whatever went on at the university had to be consistent with the teaching of the church as well as the attitudes prevalent among the social elite and the political establishment, not least the king and his advisers'. The publications were censored. However, in the Lutheran dominant Denmark there was no index of forbidden books as was the case of the Catholic Church. Subjects like physiology, mathematics and astronomy were seen as assistants of faith. The fifth chapter 'Of Tycho and his time' discusses Tycho Brahe's achievements as an astronomer and a chemist. His model of the universe was with the earth at the centre. Here we see that 'Following the persecution of Galileo in 1633 and the Catholic Church's condemnation of the Copernican system, Tycho's alternative gained a large following among Catholic astronomers' (p. 85). His student Christian Soeresen perpetuated the model. Due to his work Brahe's ideas