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An honorary collection for *Journal of Materials Chemistry C* and *Journal of Materials Chemistry B* "in memory of Professor Dr Helmut Ringsdorf"

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Recapitulation of the scientific life of Prof. Dr Helmut Ringsdorf

Prof. Dr Helmut Ringsdorf (30/07/1929–20/03/2023) was a prominent German chemist who passed away on 20th March 2023 at the age of 93. During his entire scientific career, Prof. Ringsdorf has made a significant contribution to the scientific community with his 23 366 citations and h-index of 81 in the scientific domain of supramolecular chemistry, polymer science, materials science, and biocompatible materials. Due to his achievements, which had a long-lasting impact on both basic research and real-world applications, Prof. Dr Helmut Ringsdorf is highly esteemed in the scientific community.

He was born in Giessen, Germany, and grew up in the Rheingau region, famous for its vineyards, which instilled in him a great love for wine. Ringsdorf obtained his PhD thesis under the co-supervision of Husemann and Staudinger on "reversibly cross-linkable elastomers". After completing his PhD, Prof. Ringsdorf spent two years, from 1960 to 1962, at the Polytechnic Institute of Brooklyn, New York. After returning to Germany, he served as an assistant and associate professor at the University of Marburg from 1962 to 1970. In 1970, he joined the University of Mainz as a chair professor in the organic chemistry department and kept this position until his retirement in 1994. Mainz was an evidence of his highest level of scientific research, resulting in more than 500 papers and the supervision of around 170 PhD students in a unique manner. Michael Przybylski, Helmut Ritter, Leo Gros, Rudolf Zentel, Hans-Werner Schmidt, Andre Laschewsky, and Gero Decher, among others, are a few names of postdoctoral researchers and visiting scientists associated with Prof. Ringsdorf who have carried out the legacy of Prof. Ringsdorf in academia. During his career, Prof. Ringsdorf successfully filled the gap between the life sciences and materials, starting from azomethine polymers, which have been coined as "bio-inspired materials" at present. This important discovery led Prof. Ringsdorf to be within the 100 most cited chemists worldwide. Additionally, his early work on polymeric antitumor drugs brought some systems very close to being put into use. Later on, his interest evolved into the liquid crystalline polymers, inspired by the "wheels of Mainz", and has been utilized for optical storage and photoconductive materials. Prof. Ringsdorf used to invite many people together at his home and offer them the best wine, slice of cake and "Meenzer Spundekäs" – a local cheese; thanks to his wife, Margot, for organizing such wonderful evenings. This is how he used to discuss new ideas with the colleagues and friends. Prof. Ringsdorf will be remembered for his significant contributions to the fields of polymers as nanomedicines and liquid crystalline side-chain polymers (LCPs),

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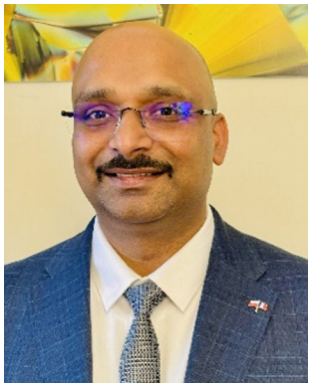
including the self-organised systems that combine order and mobility. In 2010, Prof. Ringsdorf received the Alfred Saupe Medal from the Alfred Saupe Foundation and the German Liquid Crystal Society, as well as the G.W. Gray Medal from the British Liquid Crystal Society, for his outstanding work on self-assembled systems.[1] Prof. Ringsdorf was not only an outstanding scientist but also a very good human, who always loved to play with kids and have discussions with colleagues over a cup of wine. All his colleagues have wonderful memories of him, and his departure leaves an irreplaceable void in the scientific community and among his friends.

As a gesture of gratitude for his service to science and in loving memory, we present this honorary collection in his name. This honorary collection is jointly published in the *Journal of Materials Chemistry C* and *Journal of Materials Chemistry B*, following the scope of research domains of the contributing authors.

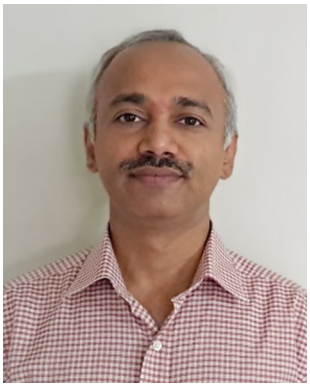
Honorary collection

In this honorary collection, we received 71 manuscripts; however, we could only accept 31 manuscripts, based on the scope and quality regulations of the journals. Since Prof. Ringsdorf was renowned for his contributions to self-organised systems and their applications involving the ordering and mobility of liquid crystal molecules, this was a major focus of the collection. Recent research activities in columnar systems (including discotics) span fundamental studies on synthesis, characterization, and device applications. Owing to their self-assembling nature and exhibiting attractive charge carrier mobility, these systems are being selected for various organic electronic and opto-electronic applications. Perylene-based



Dharmendra Pratap Singh

Dr Dharmendra Pratap Singh is an Associate Professor at the Université du Littoral Côte d'Opale (ULCO), France. He is a member of the Unité de Dynamique et Structure des Matériaux Moléculaires (UDSMM) laboratory and head of the first-year cycle of Industrial Engineering at the Engineering School of the ULCO. Dr Singh obtained his PhD degree from the Department of Physics, University of Lucknow, India in 2016. His current research activities are focused on columnar materials, discotics, ferroelectrics, nematics and ferroelectric nematic liquid crystals along with their nano-dimensional counterparts for studying charge transport mechanisms and their applications in energy, sensing, thermoelectricity, optoelectronics, photovoltaics and organic electronics. He received the Young Scientist Award from the Indian Science Congress in 2017. He was the recipient of the best research award from the Indian Liquid Crystal Society in 2012 and SPIE Early Career Award at Cambridge University in 2013. He was also awarded a Best Research award by the Korean Display Society (KIDS) in 2015 and the prestigious Raman-Charpak fellowship 2014 to work in France. He has published more than 115 research articles in esteemed journals and 4 book chapters. He is also the principal investigator of many projects, such as PHC Star, Procore, Galilée, Alliance and Samuel de Champlain with South Korea, Hong Kong, Italy, the United Kingdom, Poland, Belgium and Canada. Presently, he is serving as a reviewer for more than 40 reputed journals from the RSC, ACS, APS, Wiley, Elsevier, AIP, IOP, Springer, Nature, etc. He is also lifetime member of the International Liquid Crystal Society, Indian Liquid Crystal Society, and affiliate member of the RSC and APS. He is also serving as "Guest Editor" for journals published by RSC, Elsevier, Wiley and Springer.



Ammathnadu Sudhakar Achalkumar

Achalkumar Ammathnadu Sudhakar has been working as a full professor at the Department of Chemistry, IIT Guwahati from 2019, where he leads the Soft Matter Research Group. He is also associated with the Centre for Sustainable Polymers at IIT Guwahati. He received his PhD from the Centre for Nano and Soft Matter Sciences (CeNS) Bengaluru, then worked as a Postdoctoral Researcher at the Centre for Molecular Nano Sciences, University of Leeds, Leeds, UK (2007 to 2009), and later at RIKEN Advanced Science Institute, Wakoshi, Japan (2009 to 2011), before joining IIT Guwahati. He has been the recipient of the Indian Liquid Crystal Society Silver Medal 2019 and Chirantan Rasayan Sanstha Silver Medal 2023 for his research achievements. His research interests fall in the broad area of liquid crystals, supramolecular chemistry, functional polymers, organogels and self-assembled organic semiconductors. He is an Associate Editor of JMC C and Materials Advances.

(https://doi.org/10.1039/d5tc00409h) and some unusual-shaped (https://doi.org/10.1039/d5tc02093j) molecular self-assemblies have emerged as novel fluorescent systems, which have been utilized in organic light-emitting diodes (OLEDs) and, most recently, phenoxazine-based systems (https://doi.org/10.1039/d5tb00207a) for bioimaging applications have also been realized. In the aforementioned applications, charge carrier mobility is one of the crucial parameters of the molecular systems; therefore, various new molecular systems such as asymmetric BTBT (https://doi.org/10.1039/d5tc01598g), polynuclear Au-complexes (https://doi.org/10.1039/d5tc00575b), and halogen bonded ionic liquid crystal systems (https://doi.org/10.1039/d5tc01507c) have been realized, which enriched the literature on the "order and mobility" of self-assembling systems. Most of the columnar systems are nonpolar; as a result, it is difficult to align them using an externally applied field or a polyamide alignment layer. To unriddle this problem, polar columnar systems have been developed using subphthalocyanine units (https://doi.org/10.1039/d5tc01417d), in which molecules can be aligned using an externally applied field, and the charge carrier mobility remarkably depends upon the degree of molecular alignment. After the successful implementation of triphenylene-based discotics, triphenylamine unit-based self-assembled columnar systems and their gel counterparts have emerged as outstanding stimuli-responsive soft materials (https://doi.org/10.1039/d5tc01929j; https://doi.org/10.1039/D5TC01659B). On the other hand, non-columnar liquid crystalline materials

Matthias Lehmann

Matthias Lehmann has been a Professor in Organic Materials – Soft Materials and Liquid Crystals – since 2011 at the University of Würzburg and has held the prestigious Heisenberg fellowship of the German Science Foundation. He is a core member of the Center for Nanosystems Chemistry (CNC) and a member of the Bavarian Polymer Institute (BPI). He studied Chemistry at the University of Mainz, where he finished his PhD 1999 in the research group of Prof. Herbert Meier on liquid crystalline stilbenoid dendrimers. He began his independent career in 2003 as a Junior Professor at the Chemnitz University of Technology after Postdoc positions at the University of Zaragoza with Prof. J.-L. Serrano and the Free University of Brussels with Prof. Yves Geerts. His research interest focus on the synthesis, self-assembly and application of complex soft matter with liquid-crystalline properties as new emerging materials. Special emphasis lies on structural control, which is studied using comprehensive X-ray scattering methods, modelling and simulation. He is currently section editor-in-chief of the MDPI Journal "Chemistry", section "Chemistry of Materials".

Sandeep Kumar

Professor Sandeep Kumar is a Professor at the Department of Chemistry, Nitte Meenakshi Institute of Technology, Bangalore, India. He obtained his PhD from Banaras Hindu University, Varanasi in 1986. He was a Postdoctoral Research Fellow at the Hebrew University of Jerusalem; Technion, Israel Institute of Technology, Israel; and the Scripps Research Institute, La Jolla, USA, during 1988–1994. He worked with Professor Ringsdorf at the University of Mainz, Germany, during 1994–1995 prior to joining the Centre for Liquid Crystal Research, Bangalore, to start a new Chemistry laboratory. In 2002, he moved to the Raman Research Institute, Bangalore, from where he superannuated in November 2019 and joined NMIT. He was a visiting Research Professor at the Naval Research Laboratory, Washington DC, during 1999–2000, at the National Dong Hwa University, Hualien, Taiwan, during 2008 and E.T.S. Walton Visiting Professor at Trinity College, Dublin, Ireland, during 2012–2013. He has also visited many other countries, like the U.K., France, Switzerland, Japan, China, Korea, Malaysia, Singapore, Slovenia, Poland, and Italy to deliver lectures. He has published more than 350 research papers in top-rated peer-reviewed international journals, 3 books, 13 book chapters and 10 patents. These papers have received about 13 000 citations with h-index of 51 and I-10 Index of 250. He was awarded the inaugural LG Philips Display Mid-Career Award by the International Liquid Crystal Society in 2008, the Indian Liquid Crystal Society Lifetime Achievement award 2020 and Professor Shivaramakrishna Chandrasekhar Lecture Award 2023. Prof. Sandeep Kumar has made outstanding contributions in the field of Liquid Crystals with the highest number of publications on Discotic Liquid Crystals in the world. He is in the world's top 2% scientists list, published by Stanford/Elsevier, 2021, 2022, 2023 and 2024. ScholarGPS has placed him at the 29th position in the Top 0.05% list of all scholars worldwide in the liquid crystals field.

such as smectics, nematics, chiral nematics, or elastomeric assemblies, along with their nano- or perovskite composites, are comparatively simpler, exhibiting some eye-catching applications, like optical storage *via* photoswitching (https://doi.org/10.1039/d5tc00421g), encrypted communication (https://doi.org/10.1039/d5tc01653c), polarized emission (https://doi.org/10.1039/d4tc05268d), *etc.* The physical and chemical properties of all molecular systems are predicted by their structure–property correlation, and any subsequent change in the structure, such as altering the alkyl chain length, functional groups, fluorination, and block-oligomerization (https://doi.org/10.1039/d5tc01109d; https://doi.org/10.1039/d4tc04076g; https://doi.org/10.1039/d5tc01674f; https://doi.org/10.1039/D5TC02303C) results in significantly improved properties of the systems (https://doi.org/10.1039/d5tc01484k; https://doi.org/10.1039/D5TC02652K; https://doi.org/10.1039/D5TC02401C; https://doi.org/10.1039/D5TC01614B). Most recently, the ferroelectric property has been observed in non-chiral liquid crystalline systems, which opened a new pathway for a special class of ferroelectric nematics (https://doi.org/10.1039/d5tc01641j) and paraelectric-to-ferroelectric equilibrium in non-chiral layered liquid crystal systems (https://doi.org/10.1039/d5tc00701a). Along with the pristine liquid crystalline systems, their nanocomposite counterparts with cellulose and graphene oxide have also resulted in some interesting applications in display applications (https://doi.org/10.1039/d5tc00259a) and photomechanical actuators (https://doi.org/10.1039/d4tc04063e).

Prof. Ringsdorf was always advocating organic and polymer materials for their vast applications, from the aspects of chemistry, physics, and medicine. Thus, this honorary collection also includes work on nanostructured materials for energy and medical applications. In recent years, nanostructured materials have emerged as alternative materials for energy, sensing, drug delivery, *etc.* This honorary collection covers some specific nanostructured materials such as cellulose (https://doi.org/10.1039/d4tb02028f), porous carbon (https://doi.org/10.1039/D4TC04734F) and carbon dots (https://doi.org/10.1039/d4tb02104e), gold and silver (https://doi.org/10.1039/d5tb00815h; https://doi.org/10.1039/d5tb00636h), palladium (https://doi.org/10.1039/d5tb00620a), biopolymer gels (https://doi.org/10.1039/d4tb02068e), HPMA nanomedicines (https://doi.org/10.1039/d4tb02341b), boronic ester-crosslinked nanofibers (https://doi.org/10.1039/d5tb00738k), polyelectrolyte complex nanocomposites (https://doi.org/10.1039/d4tb02354d), glycosylated nanoparticles and polymer nanoparticles (https://doi.org/10.1039/d4tb02760d; https://doi.org/10.1039/D5TB00890E), and hydrogels (https://doi.org/10.1039/d5tb00005j) for particular applications in immunomodulation, tumors, drug delivery and theranostics, cancer therapy, wound dressings, selective detection of ammonia, bone tissue engineering, and so on.

Future directions

Future directions for columnar and nanostructured materials in organic electronics and the medicinal field are expected to focus on tailoring molecular architectures and self-assembly to achieve precise control over charge transport, optical properties, and biocompatibility. In organic electronics, advances may center on integrating columnar and conventional liquid crystalline phases and ordered nanostructures to create flexible, low-cost, and high-performance devices, including organic photovoltaics, transistors, and sensors with improved stability and efficiency. In the medicinal domain, the emphasis will likely shift toward designing nanostructured columnar systems that can serve as targeted drug delivery vehicles, bioimaging agents, or scaffolds for tissue engineering, leveraging their tunable porosity, anisotropic transport, and functional surface chemistry. Cross-disciplinary approaches, combining supramolecular chemistry, nanofabrication, and bioengineering, will be essential to overcome challenges in scalability, reproducibility, and long-term biocompatibility, paving the way for multifunctional materials that bridge electronic and biomedical applications.

Heartfelt tribute by colleagues

I remember Helmut Ringsdorf in a joyful and always relaxed mood. For example, as an invited speaker in the Chemical Colloquium at the University of Würzburg, which took place on Carnival Monday (Rosenmontag), Helmut Ringsdorf arrived with a funny nose and a bottle of local wine. By uncorking (and corking) the wine, he explained the concept of drug delivery and membrane transport in liposomes. Helmut Ringsdorf was also an excellent teacher in explaining the relevance of discotic liquid crystals and their relation to polymers in an easy understandable way to the public. He did outreach of science, before this term was even invented. On the other hand, Helmut Ringsdorf was very concerned about the impact of science on society. During conferences, he asked young and established colleagues to consider the consequences of their research on the public already in the design of research topics.''

Prof. Dr Sabine Laschat

Institute of Organic Chemistry, University of Stuttgart, Germany

Fig. 1 Top left: a meeting of Helmut Ringsdorf and Rudolf Zentel in Mainz-Gonsenheim in summer 2021 (provided by Lutz Nuhn) and reproduced with permission from *Macromol. Rapid Commun.*, 2022, 43, 2100829;[2] top right: Helmut Ringsdorf playing the game "Top" with the kids (Navdeep and Sudeep) of Sandeep Kumar; bottom left: wrapper of a wine bottle which was prepared by group members of Helmut Ringsdorf and gifted to Sandeep Kumar in 1994; bottom right: Helmut Ringsdorf and Rudolf Zentel during a seminar at the University of Mainz.

My personal interaction with Prof. Ringsdorf was very short but this one-year association completely reformed my personal and scientific life. It was my great fortune to come into contact with the late Prof. Dr Helmut Ringsdorf in 1994 and since then he has become my most revered teacher. He was a kind, lovable human and an eminent scientist. He has a vast knowledge of science as evident from his more than 500 research papers on various topics. Describing his science in a few words is beyond my capability and I would like to mention only my one or two personal feelings. Prof. Ringsdorf was fond of wine. When I joined him in 1994, a wine bottle was given to me having the quote "Moderate drinking set a man to thinking but a glass too much and he is out of touch" (the wine bottle wrapper is shown in Fig. 1). His wine cellar has many varieties of wines and his welcoming of guests at his home was unique; asking the birth year of the guest, taking guests to the cellar, picking that year of wine and celebrating. With kids he used to become a child. Playing with "tops" was his one of the favourite games he used to play, not only with kids but also with scientists, and his rules of winning were also different. The longest spinning top may not be the winner, but the position of the winner was preset by him on a piece of paper. Prof. Ringsdorf with his wife gave a set of tops, stopwatch, *etc.*, to my children. I don't have words to express my feelings towards Prof. Ringsdorf, as it is a great personal loss to me. His demise marks the end of a multidisciplinary science era but his legacy will forever remain in the hearts of countless researchers he inspired.

Prof. Sandeep Kumar
Raman Research Institute & Nitte Meenakshi Institute of Technology, Bangalore India

Helmut Ringsdorf was an extraordinary person and I had the joy of being connected to him from summer 1976 (freshman in the organic chemistry lab) till his death in 2023. His greatest ability as a scientist was to think broadly, identify new concepts and encourage people from different disciplines to work together on new interdisciplinary topics. A question behind it remains: How could he bring the necessary new information together? This would not have been possible without his many national and international contacts and without his uniquely open personality. He did not take science – and his personal understanding of science – too seriously. This allowed him to live also with many aspects of "half-knowledge" (quotation by H. Ringsdorf) and partial understanding of facts, basing his decision mostly on how much he trusted a person in the discussion. In addition, he did not "weight the arguments" by the hierarchical position of his counterpart, may he/she be a well-known professor or a young student. He was definitely not a typical professor, because professors often like to be the expert in a distinct research area. This thinking, however, then limits their investigations only to topics they are familiar with.

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Conflicts of interest

There are no conflicts to declare.

Acknowledgements

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