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Preface

The development of light-emitting polymers has been one of the most exciting areas of science over the past decade. Synthetic polymers are found throughout everyday life because they have a near infinite variety of possible structures giving a correspondingly wide range of properties and hence applications. In particular, they can be flexible and readily made into almost any shape allowing simple manufacture. Nearly all polymers are electrical insulators but one class — conjugated polymers — are an exception. The bonding in conjugated polymers leads to electrons delocalised along the polymer chains and semiconducting electrical properties. This in turn opens up a galaxy of possibilities arising from fusing the versatility of semiconductors in electronics with the scope for shaping and manufacture of polymers. It means that we can now have semiconductors dissolved in a bottle that can be painted (or more likely) printed onto surfaces to make electronic devices.

Potential applications of these materials extend as far as our imagination. One of the most promising areas arises from the fact that the light emission can be stimulated electrically, providing a new display technology. Light-emitting polymers can be used to make flat and even flexible displays which operate at low voltage with excellent contrast and viewing angle. A wide range of semiconducting polymer devices have been demonstrated including transistors, solar cells and even (optically pumped) lasers, opening up a whole new field of polymer optoelectronics. Although there is enormous technological interest in this area, the science of these materials has also proved fascinating. Indeed, the light-emission which is one of the features that makes them so attractive for applications also provides a powerful way of viewing their photophysics and photochemistry. The extensive electron delocalisation means that their excited states lie in between the localised states of small molecules and the extended states of inorganic semiconductors. Elucidating the nature of the excited states has been advanced by combining a wide range of optical spectroscopies.

The rapid development of light-emitting polymers is a wonderful example of interdisciplinary research. Physicists, chemists, materials scientists and engineers have all worked together to advance our understanding of materials and devices, and so it is especially appropriate for this interdisciplinary journal to host a special issue on this topic. Another aspect of light-emitting polymers has been that science and technology have advanced together: as the materials have improved, both the technological applications and scientific possibilities have burgeoned.

The articles in this issue capture the excitement of this field and explore the vital matter of how the properties of light-emitting polymers relate to their structure, and to the operation of devices containing them. In particular, they investigate the influence of interactions between neighbouring molecules on the light-emission process. It has become clear that such interactions have a profound effect on the photophysics of light-emitting polymers and that the way the polymer molecules pack together is as important as their chemical structure in determining properties. The influence of morphology and aggregation is a theme developed throughout the issue. In addition to understanding the role of these factors, some of the papers go on to explore ways of controlling them.

Whilst the issue is focused on light-emitting materials, the theme of intermolecular interactions discussed here is important for the wider field of polymer optoelectronics. Recent developments in devices based on single-crystal organic materials and the demonstration of superconductivity in a polymer device suggest that the next decade will be at least as exciting as the past one.

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