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Supramolecular Nanostructures Editorial

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Supramolecular assembly results from non-covalent interactions such as hydrogen bonding, van der Waals interactions, and electrostatics. Whilst individually these interactions are not very strong, when many interactions act cooperatively, this can be sufficient to result in the formation of defined structures and useful materials. The resulting materials tend to be responsive, as it can be easy to provide sufficient energy to modify the interactions such that new structures are favoured, or such that the structures fall apart. The Nobel Prize for Chemistry has been awarded twice for aspects of Supramolecular Chemistry, and there is now a huge diversity of materials that can be formed. In this Special Issue, we aim to highlight further the importance of this field, which span a wide range of areas.

For example, supramolecular nanostructures are hugely important in optoelectronics. Militzer et al. demonstrate how hydrogen bonding can be used to modify and control the self-assembly of diketopyrrolopyrrole derivatives, enabling tuning of the bandgap. Lace et al. show how the simple addition of sugar into solutions of a self-assembled perylene bisimide can dramatically increase the radical anion lifetime and photoconductivity of the resulting films. Increased photoconductivity is also described by Ghosh et al. by controlling phase separation. Ravi et al. control the supramolecular interactions in a self-assembled donor-acceptor-donor type molecule to prepare an up-converting resonator. Ghosh et al. have used charge-transfer as a means of inducing a phase change from vesicles to tapes. Underpinning all of these is the control of architecture and molecular spacing.

Supramolecular nanostructures are widely discussed in the arena of biomaterials and drug delivery. This is exemplified here by Cheng et al. who prepare nanoparticles using supramolecular interactions. Eren et al. describe the mineralisation of supramolecular gels with calcium phosphate for bone growth. Enzyme-degradable peptide-based polyion complexes have been prepared and characterised by Insua et al., which could be used for drug delivery. Carbon-dot based structures for chemotherapy are described by Feng et al.

Interesting new concepts are also discussed. For example, a new proces to prepare silicon nanowires without a mask is described by Veerbeek and Juskens. Lovrak et al. show how supramolecular gels can be used to glue together two polymer gels. Incorporating different components that can react for form a gel into two polymer gels allows for reaction, self-assembly and gluing on contact. Foster et al. have controlled interactions in supramolecular gels to switch between self-sorted and co-assembled structures. A detailed examination by Angulo-Pachón of the gelation efficiency of an amino acid based gelator shows the importance of molecular structure. Martí-Centelles et al. also discuss the effect of molecular structure on gelation ability for a number of modified phenylalanines and diphenylalanines. On a related fashion, Zhu et al. describe the use of specific hydrogen bonding and complexation to prepare orthogonal supramolecular structures. Dorca et al. discuss the use of chirality in the formation of helical supramolecular polymers and della Salla et al. nicely discuss the complex, hierarchical assembly of an amphiphile, examining assembly across length scales.

Supramolecular nanostructures can give rise to interesting optical effects, with the aggregation controlling the properties. In this issue, switching of the circularly polarised luminescence in a supramolecular structure is shown by Hashimoto et al. and luminescence enhancement in supramolecular structures is discussed by Kuppan and Maitra. Nanostructures that give rise to aggregation-induced emission are shown by Zhao et al.

Last, but not least, we have a number of really useful reviews. Chakraborty and Gazit review the supramolecular structures that can be formed from amino acids. Townsend et al. review the electroactive amphiphiles, and their ability to form responsive supramolecular materials. Jiang et al. discuss chiral 1D nanostructures.

We hope that you enjoy the articles in this issue. The diversity and range of papers should hopefully have something to interest everyone and inspire the future development of this exciting field of research.