Conference Report on the MRS Meeting 2016

From 28 March to 1 April 2016, material scientists and engineers from across the world gathered in Phoenix (Figure 1) for the Materials Research Society (MRS) Meeting and Exhibit.

Coming from 55 countries, a total of 4,416 registrants and 145 exhibitors were in attendance. MRS has selected Phoenix as the new host for the spring meeting, which historically has been held in San Francisco. Over 62 symposia spanning a range of topics including materials characterisation, electronics, energy and environment, materials design, nanotechnology and soft materials were held. One of these 62 symposia was held in the ‘Soft Materials’ topical cluster and titled ‘Liquid Crystalline Materials – Displays and Beyond’.

The symposium was held over 2 days composed of 37 talks and 14 posters. The symposium organisation was led by Dr. Tim White (Air Force Research Laboratory) and co-organised by Prof. Liang-Chyi Chien (Kent State University), Prof. Helen Gleeson (University of Leeds) and Prof. Ivan Smalyukh (University of Colorado). The symposium aimed to focus both on current advances in displays as well as the exploration of the application of these materials ‘beyond’ displays. As such, research presentations detailed not only how these materials are improving phone screens and TV displays but also highlighted a diverse set of topics ranging from photovoltaics to phototherapy. The sessions were categorised as follows: Shape Control and Actuation, Electro-Optics, Material Synthesis, Property Enhancement with Nano-inclusions, Light and Alignment, Fibers and Self Assembly and Energy.

A number of talks were noteworthy. Of them, Prof. Helen Gleeson delivered an engaging talk on her recent research of poly(methyl methacrylate) based contact lenses that address presbyopia through controllable birefringence, derived from commercial liquid crystals (LCs) and low operating voltages. With transition times currently under 1 second, these dynamic contact lenses could enable the variable focus necessary to replace bifocal hard lens.

Prof. Nicholas Abbott, shown in Figure 2, of University Wisconsin Madison discussed recent work probing the nanoscopic self-assembly of small molecules catalysed by topological defects. Using photocrosslinkable amphiphiles, it was demonstrated that nanoscopic ‘o-rings’ could be synthesised in the presence of saturn-ring disclinations. More information on this work can be found in Nature Materials 15, 106–112 (2016).

One of the benefits of holding symposium at large meetings like MRS is the opportunity to expose graduate students to the community, both in oral and poster presentations. Graduate student Matthew McBride, also photographed in Figure 2, from the University of Iowa, presented on his research of dynamic contact lenses that address presbyopia through controllable birefringence, derived from commercial liquid crystals (LCs) and low operating voltages.

Figure 1. (a) Boojum Tree at the Phoenix Botanic Gardens. (b) National landmark, Four Peaks, off the skyline of Phoenix.
Colorado spoke about advances in the materials chemistry of liquid crystalline polymer networks and elastomers. Mr. McBride detailed his thesis work focused on incorporating allyl sulphides within cross links of these materials and demonstrated that both heat- and light-driven processes selectively adjust birefringence and alignment of LCs. Birefringence in these materials was maintained up to 160°C. The work was collaborative with Prof. Dick Broer at the Technical University of Eindhoven.

Another graduate student Nadine Tchamba Yimga, working with Prof. Elizabeth von Hauff, presented on the applications of using a novel small molecule with crystalline to nematic to isotropic transition temperatures at 160–250°C in flexible semiconducting materials. Nadine reported with manipulating processing (annealing) conditions, and subsequent crystallite domain sizes, there is a change in carrier mobility with increasing mobility relative to crystallite size.

Makiko Quint, also a graduate student working between Prof. Sayatani Ghosh and Prof. Linda Hirst at the University of California Merced, detailed efforts focused on mesogen-grafted gold nanoparticles mixed with 4-Cyano-4’-pentylbiphenyl (5CB) for potential use in photo-thermal therapy. After dispersing the gold in the isotropic phase of 5CB, cooling the mixture into the nematic phase resulted in the gold nanoparticles organizing into 3D microshells. These structures maintained integrity over extended time periods. Using laser-induced plasmonic heating, it was possible to produce significant heating and release the contents that could...
be trapped in the gold structures. This could be an approach to selective encapsulation and controlled release of drugs.

Dr. Elaine Lee, at the time a graduate student of Prof. Shu Yang lab at the University of Pennsylvania, detailed a methodical approach towards realising plasmonic hybrids using defect-induced assembly. Within mixtures composed of poly(styrene)-grafted gold nanorods and 4′-n-octyl-4-cyano-biphenyl (8CB), infiltrating micropillar arrays aligned the LC director and was shown as a promising method to align gold nanorods while simultaneously achieving peak signal an order of magnitude higher than previously reported. By modulating temperature, the longitudinal surface plasmon resonance was shown to shift up to 100 nm.

Dr. Tim White of the Air Force Research Labortaory was recognised by the MRS as one of two recipients of their ‘Outstanding Young Investigator Award’ (Figure 3). Dr. White presented an award lecture titled ‘Programming Liquid Crystal Elastomers—Elasticity, Actuation, and Beyond’ and was recognised at the MRS Awards banquet.

The symposium is yet another confirmation that LCs remain an active and vibrant topic of research. The symposium attracted many curious onlookers from other research areas and disciplines. While there are countless topical meetings on liquid crystals as well as biannual symposia at Society of Photographic Instrumentation Engineers (SPIE), holding occasional symposium at meetings like MRS is a great way to increase the accessibility and awareness of our exciting field of research.

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