

This article was downloaded by:

On: 16 January 2011

Access details: *Access Details: Free Access*

Publisher *Taylor & Francis*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Liquid Crystals Today

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713681230>

Report on the symposium 'Liquid Crystal Micro- and Nano-Composites'

Isabel M. Saez^a

^a University of York, York, UK

Online publication date: 01 December 2010

To cite this Article Saez, Isabel M.(2008) 'Report on the symposium 'Liquid Crystal Micro- and Nano-Composites'', *Liquid Crystals Today*, 17: 1, 11 – 13

To link to this Article: DOI: 10.1080/13583140802650541

URL: <http://dx.doi.org/10.1080/13583140802650541>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Report on the symposium ‘Liquid Crystal Micro- and Nano-Composites’

Isabel M. Saez

University of York, York, UK

The School of Physics and Astronomy of the University of Manchester played host to 40 delegates at the one-day symposium ‘Liquid Crystal Micro- and Nano-Composites’ organised by Dr I. Dierking and the Liquid Crystal research group in Manchester on 9 January 2008.

The combination of functional materials with liquid crystals as a means of inducing ordered nanostructured assemblies, and control of their morphologies and function, has become a subject of intense activity in liquid crystal research and this one-day symposium on micro- and nano-composites reflected the state of the art in this area.

The symposium was organised around two sessions, opened by the plenary talks of Slobodan Žumer and Philippe Poulin, and several contributed presentations, together with a poster session. The contributions highlighted the potential impact for developing new understanding and raising future opportunities in the field of liquid crystal composites.

Slobodan Žumer (University of Ljubljana and the Josef Stefan Institute, Ljubljana, Slovenia), in his presentation ‘Nematic colloids: from dimers to braids’, addressed recent modelling of defects and colloidal structures formed in spatially confined nematic liquid crystals and how these are in excellent agreement with experimental observations. He described the lattices of colloidal dimers formed by an entangled network of disclination lines and how these dimers are coupled to form chains, wires and interconnected braids. Furthermore, he presented two-scale colloidal inclusions in liquid crystals, showing how the small-scale particles can be arranged as a ring around the larger particles or around the topological defects that keep together the larger-scale dimers in a metastable assembly, allowing the formation of nematic colloidal gels and glasses with hierarchical organisation. These organised gels may open new ways to the assembling of photonic crystals that can lead to metamaterials.

Sharon Jewell (University of Exeter, UK) reported in her presentation ‘Confocal microscopy imaging of micro-spheres in liquid crystals’ on the use of fluorescence confocal polarising microscopy as a technique for imaging the director distortions of



liquid crystals doped with microparticles. This technique, which allows spatial resolution of around one micron, has been used to explore the perturbation of the director of a cholesteric liquid crystal induced by doping with 5 μm silica beads.

‘Manipulating clay particles in nematic hosts using fields’, presented by Rob Richardson (University of Bristol, UK), addressed the assembly of clay platelets into stacks and their alignment by applied fields. The assembly of clay platelets stabilised by cationic surfactants in nematic liquid crystals and non-mesogenic organic solvents was studied by X-ray scattering, showing that different solvents induce different distributions. In liquid crystal hosts, stacks of typically four plates are observed. In the presence of magnetic fields, the platelet stacks in non-mesogenic solvents are aligned so that the platelet plane is parallel to the aligning film. In nematic hosts,

the competition between the direction of the stacking and the director of the host results in the stacks of platelets aligning with their planes perpendicular to the applied magnetic field.

Philippe Poulin (CNRS, Bordeaux, France) presented 'Dispersions and ordered assemblies of carbon nanotubes', addressing various approaches to achieve macroscopic alignment and percolated networks in liquid, solid and liquid crystalline solvents. Based on recent studies showing that the percolation threshold of rod-like particles is lowered in the presence of attractive interactions, he demonstrated how low-percolation thresholds of carbon nanotubes can be achieved, which should strengthen the technological applications of carbon nanotubes in electrostatic dissipation or electromagnetic shielding. Conversely, repulsive interactions on carbon nanotubes, such as those induced by the absorption of DNA or hyaluronic acid, induce different behaviour leading to the formation of the nematic phase. He discussed the nature of the dispersions of carbon nanotubes in polyvinyl alcohol (PVA), showing the shape and temperature-memory effect of the polyvinyl alcohol-carbon nanotube (PVA-CN) composites and their use in the fabrication of aligned composites.

'Characterisation of carbon nanotube-thermotropic nematic liquid crystal composite materials'



presented by Okasana Trushkevych (University of Cambridge, UK), highlighted the difficulty in obtaining stabilised dispersions of nanotubes in liquid crystals and compared the various methods of ascertaining the equilibrium concentration of nanotubes in the host. The combination of Raman spectroscopy, photoluminescence, confocal microscopy, dynamic light scattering, atomic force microscopy (AFM), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and the observation of the defects induced by optical microscopy have been used to characterise the composites and ongoing work in this area was presented.

Xiangbing Zeng (University of Sheffield, UK) introduced the characterisation, by advanced X-Ray diffraction techniques, of the mesophases formed by mesogen-stabilised gold nanoparticles in his talk 'Thermotropic mesophases in mesogen covered gold nanoparticles'. X-ray experiments on powder and oriented samples have demonstrated the presence of columnar hexagonal and rectangular two-dimensional lattices of gold nanoparticles, with nematic order in the mesogens, arranged with their director parallel to the column axis. Reconstruction of the electron density map showed that the columns are shifted approximately one third of the nanoparticle interdistance within a column.

The application of carbon nanotubes as a liquid crystal alignment layer and as electrode structures was presented by Tim Wilkinson (University of Cambridge, UK) in his talk 'Sparse multiwall carbon nanotube electrode arrays for liquid crystal photonic devices'. Vertically aligned carbon nanotubes, sparsely grown on silicon substrates, have been used as an electrode array that can be used to address a liquid crystal cell. The electric field profile created is almost Gaussian in shape and can be used to reorient a planar aligned nematic liquid crystal, creating a graded refractive-index profile across the cell. The micro-optical element formed acts as a micro-lens capable of focusing an applied light wave and can be tuned by varying the applied field and thereby reorienting the liquid crystal and varying the optical properties of the micro-lens.

The poster session was characterised by the high quality of the presentations. Among others, several presentations by Ingo Dierking's group (Manchester, UK) reported on the elastic behaviour of carbon nanotube-liquid crystal dispersions, investigating how the reorientation dynamics and the viscosity of the thermotropic liquid crystalline host are affected by doping with single and multiwall carbon nanotubes and how the nanotubes are oriented by the elastic fluid. In a related poster, Jan Lagerwall

(Stuttgart, Germany) presented on the rheological and electro-optic behaviour of lyotropic liquid crystal-carbon nanotube composites, focusing on the phase sequence, switching dynamics and the effect of ion content of these uniform dispersions. The structure of colloid-nematic gels formed by dispersions of fluorescently dyed polymethylmethacrylate (PMMA) particles stabilised by chemically grafted polymer brushes in nematic hosts was discussed by T. Atwood (Edinburgh University, UK). The Best Poster Award was presented to Iain Kinloch (University of Manchester, UK).

