8th Annual Early Career Colloid Meeting

ECCo 2026

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Welcome

Welcome to the 8th Early Career Colloid Meeting 2026

Welcome to the Early Career Colloid Meeting 2026 (ECCo 2026). Now into its 8th year, this event aims to bring together early career colloid scientists from industry and academia and provide a forum for discussion, networking and knowledge exchange.

We are pleased to welcome you to the University of Hertfordshire. Founded in 1952 as a Technical College on land donated by the then Chairman of the de Havilland Aircraft Company, the University of Hertfordshire has over 70 years of technical education, research and innovation rooted in close collaboration with industry. Its earliest courses emphasised mechanical and aeronautical engineering and the natural sciences, reflecting the demands of Britain's aviation industry. This heritage is still visible today in the façade of the University's newest building, Spectra, whose corrugated metal exterior pays homage to the de Havilland hangars.

The University is based primarily in Hatfield, Hertfordshire, across two campuses: College Lane and de Havilland. Both are within easy reach of some excellent local attractions. Just minutes from campus, Hatfield House is a Jacobean mansion built between 1607 and 1611, renowned for its internationally significant architecture and collections, and surrounded by beautifully designed gardens and parkland with over 400 years of heritage. If you are staying for longer, the Warner Bros. Studio Tour: The Making of Harry Potter is a short trip away in Watford, and the cathedral city of St Albans, with its Roman remains and medieval architecture, is well worth an afternoon.

We are grateful to the generous sponsorship of the UK Joint Colloids Group (JCG), a joining of the SCI's Colloid and Surface Chemistry Group and the RSC's Colloid and Interface Science Group.

Welcome to the University. We hope you have a great trip to Hatfield and enjoy the conference.

Dr Sam Aspinall and Dr Niamh Haslett
ECCo 2026 Local Organisers

Welcome from the Chair of the Early Career Colloid Network

I, on behalf of the organising committee and the UK Joint Colloids Group, our 2026 sponsor, would like to thank you wholeheartedly for joining us. We hope you find the conference and associated networking both interesting and valuable. This meeting is the only national conference specifically aimed at early career academic and industrial researchers in Colloid Science. Our aim is to provide a forum for discussion, network building and to facilitate knowledge exchange for early career researchers in all aspects of Colloid Science. We value your participation, and your feedback.

This year we are pleased that ECCo continues to be the venue to confer the prestigious Katharine Burr Blodgett (KBB) award to the best PhD research in the field of colloid science, decided by a panel of the Joint Colloids Group.

Please feel free to come and talk to the committee members anytime during the event, either during a coffee break, or on Friday lunchtime during the 'Meet the Committee' session. Finally, we are always looking for new members to join the committee, so if this is something you are interested in doing, please let us know.

Dr Priyanka Dey
Committee Chair

Committee Members

Dr Priyanka Dey
University of Portsmouth
Chair

Dr Gregory Smith
ISIS Neutron and Muon Source
Secretary

Dr Sam Aspinall
University of Hertfordshire
Treasurer

Dr James Hallett
University of Reading
Social Media Manager

Dr Clare Rees-Zimmerman
University of Bath
Website Manager

Dr Bin Yang
AstraZeneca
Industry Liaison

Dr Naval Singh
Lancaster University

Dr Sam Wilson-Whitford
Aston University

Local Organisers

Dr Sam Aspinall
University of Hertfordshire

Dr Niamh Haslett
University of Hertfordshire

General Information

How to get to UH College Lane campus

The event will be held on the College Lane campus at the University of Hertfordshire. The nearest train station is Hatfield Train Station. There is a taxi rank located at the front of the station, and Uber is readily available. Alternatively, you can take Uno buses 341, 602, 614, 644, 641, or 653 from Bus Stop 2 to campus in around 10 minutes, cycle in 10–15 minutes or walk in about 30 minutes.

If you are driving, UH's College Lane campus sits just off the A1, very close to the M25. There is designated visitor parking on campus, and more information on this can be found at the following link. https://www.herts.ac.uk/contact-us/parking

Internet access

UH uses the Eduroam network, which is available to those with institutional access. You should be able to access Eduroam anywhere on the UH College Lane Campus.

If you need to register for Wi-Fi access as a guest, you can connect using the '_The Cloud' Wi-Fi network. If you are having trouble connecting on the day, please ask one of the UH representatives for assistance.

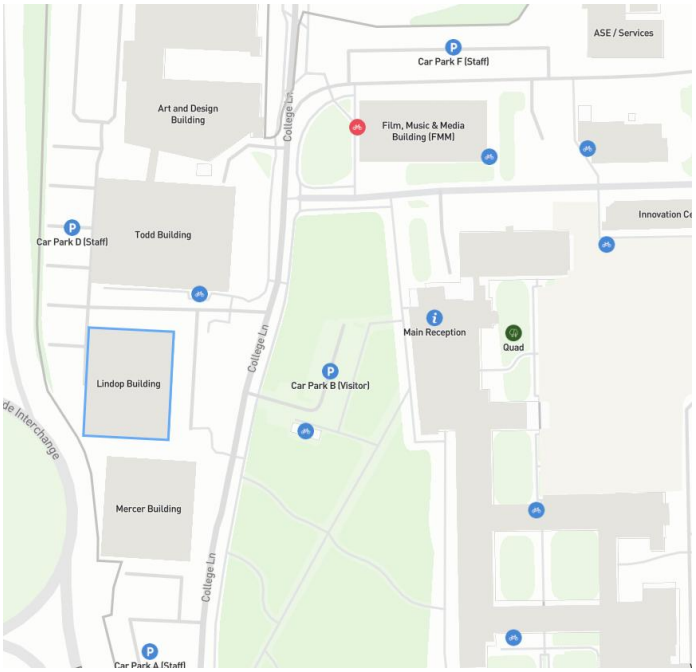
Dinner Thursday Evening at Red Lion Hatfield

There will be a conference dinner at the Red Lion Gastropub in Hatfield at 7 pm. **Please fill in this form to preorder your choices for dinner > ECCo Dinner Choices – Fill in form.** Please complete this as soon as possible, so we can successfully send off the preorders. If you have any queries about the food selection or need to let us know about anything related to this meal, please email Niamh Haslett at n.haslett@herts.ac.uk.

This venue is located a 5-minute walk from Hatfield train station or a 35-minute walk from College Lane Campus. There are buses that run toward the train station approximately every 15 minutes, Ubers take about 5 minutes and are easily accessible from the College Lane campus. Alternatively, some carpool arrangements can be made on the day.

Venue map

The meeting will be held in the Lindop Building in Room A161. The easiest route of entry is through Main Reception. Upon arrival at reception, look for the ECCo signposting to the registration desk, from where you will be directed to the conference rooms. There is an interactive map of the College Lane campus, to help you find your way to the Lindop Building. Parking is available in Car Park D for £3 a day.



https://maps.herts.ac.uk/

Lindop Building Reception Entrance

Royal Society of Chemistry Publishing Poster Prize

Continuing in 2026, we are awarding the Royal Society of Chemistry Publishing Poster prize for the best poster presented at an ECCo meeting.

We are pleased that three excellent journals in the field of colloid and interface science have partnered to sponsor this prize for 2026. *Soft Matter* focuses on advances in interdisciplinary soft matter science from across disciplines, *Nanoscale Advances* covers the breadth of nanoscience and nanotechnology, and *RSC Applied Interfaces* highlights interfacial and surface research with an applied relevance. These are clearly relevant for the field of colloid and interface science, and all journals publish excellent research of interest to our community.

The winner of the poster prize will be chosen by the members of the ECCo committee who will base their decision on the quality of flash presentation, the clarity of the poster, and the scientific rigour of the content. The prize will be presented at the end of ECCo 2026. The winner will receive both a £200 cash prize from *Soft Matter* and *RSC Applied Interfaces* and a £200 RSC Publishing book prize from *Nanoscale Advances*.

We appreciate the support from *Soft Matter*, *Nanoscale Advances* and *RSC Applied Interfaces* to recognise excellence in colloid and interface science through the Royal Society of Chemistry Publishing Poster Prize.

Programme

Early Career Colloid 2026 Meeting (ECCo 2026) Programme

The meeting will be held in Lindop Building (room A161), University of Hertfordshire, College Lane Campus.

Day 1, 25 June 2026

Time	Event	Speaker
12:00-13:30	**Registration and Lunch**	
Plenary Session 1 and Welcome (Chair: Naval Singh)		
13:30-13:45	Welcome	Sam Aspinall, Local Organiser
13:45-14:30	Building with Light: Soft Matter, Serendipity and Scientific Identity	Rachel Evans, University of Cambridge
Presentations Session 1 (Chair: Sam Aspinall)		
14:30-14:45	Plant protein filament technology for calcium delivery	Yashaswini Premjit, University of Leeds
14:45-15:00	Controlling polymer nanoparticle fusion	Stephen D P Fielden, University of Birmingham
Flash Poster Presentations (Chair: Niamh Haslett)		
15:00-15:05	Diffusiophoretic Manipulation of Colloidal Particles in Viscous Media	Nikita H Lad, Lancaster University
15:05-15:10	Small-angle neutron scattering at the ISIS neutron and muon source	Gregory Smith, ISIS Neutron and Muon Source
15:10-15:15	Crosslinked Polyester Latexes as Degradable Alternatives for Acrylate PSAs: A High-Solids, Solvent-Free Approach	Alex J Fletcher, University of Warwick
15:15-15:20	Complexation and protection of dsRNA by pH-responsive block copolymers in varying pH and electrolyte conditions	Deborah Barker, University of Leeds
15:20-16:30	**Poster Session and Refreshments**	
Panel Discussion (Chair: Gregory Smith)		
16:30-17:00	Colloids and Careers	Rachel Evans and Izabela Jurewicz
From 19:00	**Conference Dinner**	

Day 2, 26 June 2026

Time	Event	Speaker
08:30-09:00	**Arrival and Refreshments**	
Plenary Session 2 (Chair: Niamh Haslett)		
09:00-09:45	Bridging the Valley of Death: How Polymer Colloids are Revolutionizing Vaccine safety and reducing Waste	Izabela Jurewicz, Advanced Material Development Ltd and University of Surrey
Presentations Session 2 (Chair: Sam Wilson-Whitford)		
09:45-10:00	Zeta potential and electrophoretic mobility of uncoated and protein coated gold nanoparticles	Henry Peterson, University College London
10:00-10:15	Composition of fluids in nanoconfinement	Lauriane Pierrot Deseilligny, Oxford University
10:15-10:30	Diffusiophoresis and diffusioosmosis-driven dynamics of modified polystyrene colloids in long double-junction microchannels	Christina Puijk, University College London
Conference photograph		
10:30-11:00	**Refreshments and Sponsor Exhibition**	
Presentations Session 3 (Chair: Naval Singh)		
11:00-11:15	Modelling the motion of chemically-driven isotropic colloids and drops along a rigid surface	Nikhil Desai, University of Birmingham
11:15-11:30	Structure-property relationships in Pluronic/Hyaluronic acid micellar polycrystals	Koduvayur A Ramya, ISIS Neutron and Muon Source
11:30-11:45	Structure of Aerosol OT inverse micelles from neutron diffraction	Gregory N Smith, ISIS Neutron and Muon Source
Award Session (Chair: Clare Rees-Zimmerman)		
11:45-11:50	Introduction to Katherine Burr Blodgett Award	Clare Rees-Zimmerman
11:50-12:20	Harnessing Light-Responsive Behaviour in Self-Assembled Materials	Beatrice E Jones, University of Cambridge (2025 Award Winner)
Prize Presentation		
12:20-12:30	Awarding of the Royal Society of Chemistry Publishing Poster Prize & Closing Remarks	Gregory Smith
12:30-13:30	**Lunch with "Meet the Committee informal session"**	

Plenary Speaker Abstracts

Building with Light: Soft Matter, Serendipity and Scientific Identity

Rachel C. Evans
Department of Materials Science & Metallurgy, University of Cambridge

Academic careers are often described as neat, linear journeys, but in reality, they tend to be shaped by detours, chance encounters, and ideas that only in hindsight reveal how closely they connect. In this talk, I'll share how my own research has evolved at the interface of photophysics and soft matter, brought together by a long-standing fascination with how light interacts with structured materials, as both a probe and a tool for control.

My work now centres on light-responsive colloids, surfactants and liquid crystalline systems, alongside photofunctional materials for solar energy conversion and optical sensing. Across these areas, a common thread has been using light (or particles) to understand structure and dynamics, while also harnessing it to guide assembly and function. This direction didn't emerge intentionally or suddenly, but grew gradually through shifts in field, new collaborations, unexpected opportunities and plenty of setbacks! I'll reflect on how a scientific identity develops over time, how research coherence often becomes visible only when you look back, and how working across boundaries can open up unexpected and rewarding directions.

Rachel C. Evans is Professor of Materials Chemistry at the Department of Materials Science, University of Cambridge, where she leads the Photoactive Materials Research Group. Her research focusses on materials design and structure-function interplay in photoactive materials for energy, sensing, and delivery technologies. A recipient of the RSC/SCI McBain Medal (2022), the MacroGroup UK Young Researcher's Medal (2017), and the Dillwyn Medal for STEMM from the Learned Society of Wales (2017), Rachel is passionate about sustainable laboratory research practices, improving research culture and early career mentoring.

She obtained her MChem and PhD in Chemistry from Swansea University, before holding postdoctoral research fellowships at the Université Paris-Sud, France and then between the Universities of Coimbra and Aveiro in Portugal. From 2009-2017, she was Assistant, then Associate Professor of Physical Chemistry at Trinity College Dublin, Ireland, where she co-founded Senoptica Technologies to commercialise an optical sensor platform technology aimed at reducing food waste.

Bridging the Valley of Death: How Polymer Colloids are Revolutionizing Vaccine safety and reducing Waste

Dr Izabela Jurewicz
Advanced Material Development Ltd and University of Surrey, School of Mathematics and Physics

Ensuring vaccine potency throughout global distribution remains one of the most persistent challenges in public health, with the World Health Organization (WHO) estimating that up to half of all vaccines are wasted due to heat exposure or cold chain failures. Vaccine vial monitors (VVMs) provide a critical safeguard by offering a visual indication of cumulative thermal exposure directly on each vial.

I will present a new generation of low cost, industrially scalable VVMs, that leverages polymeric photonic crystal architectures that undergo an irreversible, optical transition following cumulative heat exposure—an approach optimised for manufacturability, global accessibility, and colour-blind–safe visual readout. This emerging technology demonstrates how deep tech materials innovation can be translated into real world impact—reducing vaccine waste, strengthening global immunisation systems, and offering a competitive and scalable alternative.

Beyond the scientific advances, the talk will centre on the commercialisation journey: navigating the 'valley of death' between discovery, academic research and market, building an industrial supply chain, aligning to WHO VVM categories, and preparing for regulatory validation in WHO approved laboratories. Furthermore, it will highlight how collaboration between academia and industry can accelerate innovation and drive real-world solutions. I will share insights from my personal journey, detailing the transition from researcher to Chief Scientific Officer, and the challenges and opportunities encountered along the way.

Dr Izabela Jurewicz is Chief Scientific Officer at Advanced Material Development Ltd., a UKRI Future Leaders Fellow, and a Senior Lecturer in Soft Matter Physics at the University of Surrey. She specialises in advanced functional materials, leading the Interdisciplinary Research on Interface Structures (IRIS) Group, with work spanning nanomaterial self-assembly to polymeric photonic crystal-based colorimetric sensing technologies. She has published over 40 peer-reviewed papers with multiple patents. Her research has received extensive international recognition and drives high-impact innovation across academia and industry.

Katharine Burr Blodgett Award Abstract

Harnessing Light-Responsive Behaviour in Self-Assembled Materials

Beatrice E. Jones,[a] Nathan Cowieson,[b] and Rachel C. Evans[a]

[a] Department of Materials Science and Metallurgy, University of Cambridge, 27 Charles Babbage Road, Cambridge
[b] Diamond Light Source, Harwell Science and Innovation Campus, Didcot, Oxfordshire

The next generation of smart, responsive technologies require materials whose properties can be controlled on the nanoscale. To create functional materials, lyotropic liquid crystals (LLCs) are ideal due to their hierarchically-ordered nanostructures that are highly sensitive to their environment. LLCs are formed from the self-assembly of surfactants on the addition of a solvent and can be made light-responsive by incorporating photoswitchable chemical groups, such as azobenzene, to form photosurfactants (PS). On irradiation with light, PS change shape and polarity, which has been shown to affect the self-assembled LLC nanostructure.[1] However, the mechanisms through which these structural changes occur are not fully understood and their full potential as functional materials is yet to be unlocked.

In this presentation, the design of new, light-responsive LLC systems for various applications will be explored. First, UV-induced structural disordering is shown to contribute to solar energy storage.[2] Second, a new set of arylazopyrazole photosurfactants,[3] which display a light-induced hexagonal-to-cubic mesophase transition, are exploited to selectively control gas diffusion across a membrane.[4] Third, light-responsive cubic LLC dispersions are formed, where the lattice can be 'squeezed' on-demand using light for controlled release of a molecular payload for targeted drug delivery.[5] To understand the dynamic light-response in these self-assembled systems, a method for in-situ light irradiation during small-angle X-ray scattering experiments was developed.[6,7] This mechanistic understanding provides new insights into how structural changes occur and opens the doors to their optimisation for new applications.

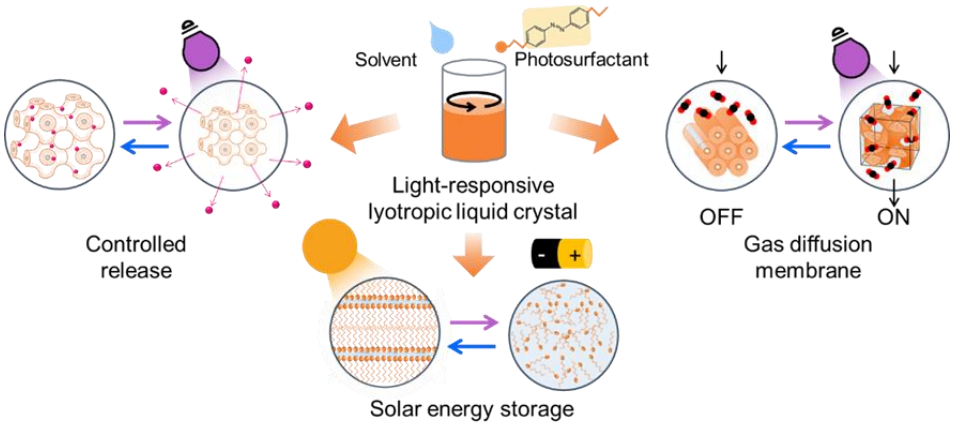


Figure 1. Light-responsive lyotropic liquid crystals, formed on mixing photosurfactants with solvent, have nanostructures which can be modified on-demand using light. Different responses can be harnessed for controlled delivery, solar energy storage and diffusion membrane applications.

References

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[3] Tyagi, G. *et al., JACS Au*, **2022**, 2, 2670.
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[6] Jones, B. E. *et al. J. Synchrotron Radiat.* **2024**, 31, 763.
[7] Jones, B. E. *et al. Beilstein J. Org. Chem.* **2024**, 20, 2005.

Oral Presentation Abstracts

Plant protein filament technology for calcium delivery

Yashaswini Premjit [1,2], *Elizabeth Tenorio Garcia* [1], *Andrea Araiza Calahorra* [1], *Simon D. Connell* [3], *Anwesha Sarkar* [1,2]

[1] *Food Colloids and Bioprocessing Group, School of Food Science and Nutrition, University of Leeds, UK*
[2] *National Alternative Proteins Innovation Centre (NAPIC), UK*
[3] *Molecular & Nanoscale Physics Group, School of Physics and Astronomy, University of Leeds, UK*

Calcium fortification of plant-based dairy alternatives is often limited by low mineral delivery and compromised textural properties, such as grittiness and astringency. This study has designed and characterised a novel filamentous self-assembly of calcium, potato protein and a biopolymer, termed as 'CaPoBio', designed for effective calcium delivery while providing optimised mouthfeel. Self-assembly was governed by the hydrophobic interactions of potato proteins forming nanoscale protofilaments mediated by pH and calcium ion concentration under thermal treatment.The filaments were further extended and organized into bundles by electrostatic interactions with biopolymers. Multiscale structural characterization from nano to microscale using Optical microscopy, Confocal Laser Scanning Microscopy (CLSM), Raman spectroscopy together with Coherent Anti-strokes Raman Scattering (CARS) and Stimulated Raman Scattering (SRS) and Atomic Force Microscopy (AFM) revealed that the potato protein-polysaccharide were integrated within the filamentous assembly whilst calcium ions acted as a glue connecting the filaments, ranging in length over 100 µm's and diameter of 500-600 nm. Scanning Electron Microscopy (SEM)-Energy Dispersive X-ray Spectroscopy (EDX) confirmed calcium localisation within the assembled network, supporting mineral association with the protein rather than the polysaccharide-domains. Strikingly, lubrication measurements revealed exceptionally low boundary friction coefficients (< 0.01) of CaPoBio formulations unlike the individual components or their mixtures in non-composite state, largely attributed to the filamentous architecture that could entrain into the contact whilst the biopolymer provides hydration lubrication. Overall, CaPoBio formulation provides a highly promising route for calcium delivery with desirable oral lubrication properties relevant to dairy alternative formulations.

Acknowledgements
This work was funded by the Collaborative Funding Program (CPF) of the UK National Alternative Protein Innovation Centre (NAPIC), which is an Innovation and Knowledge Centre funded by the Biotechnology and Biological Sciences Research Council (BBSRC) and Innovate UK (Grant Ref: BB/Z516119/1).

Controlling polymer nanoparticle fusion

Stephen D. P. Fielden,[1]* Sean M. Collins,[2] Matthew J. Derry,[3] Caterina Ducati,[4] Simon M. Fairclough,[4] Alisha J. Miller,[1] Rachel K. O'Reilly[1] Paul D. Topham,[3]

[1]School of Chemistry, University of Birmingham, Edgbaston, Birmingham, UK
[2]Department of Materials, Imperial College London, London, UK
[3]Aston Institute for Membrane Excellence, Aston University, Aston Triangle, Birmingham, UK
[4]Department of Materials Science and Metallurgy, University of Cambridge, Cambridge, UK

Particle fusion is often used for producing hybrid materials in Biology.[1] For example, the fusion of cells is crucial for fertilisation, muscle formation and tissue repair. Here we present selective and tuneable polymer nanoparticle fusion under kinetic control.[2] Fusion can be directed to occur either upon application of a stimulus[3] or between two polymer nanoparticle populations to produce hybrid nanoparticles.[4] The extent of fusion can be tuned by polymer structure. The fusion process is characterised by transmission electron microscopy (TEM) and in-situ small angle X-ray scattering (SAXS), as well as fluorine labelling combined with electron energy loss spectroscopy (EELS). Integrating together populations of nanoparticles is a first step to realising systems level behaviour with self-assembled polymers, whereby molecular and macromolecular structure can be used to direct nanoscopic behaviour.[5]

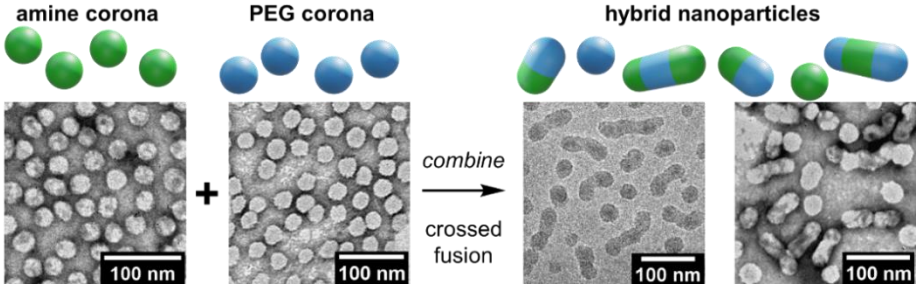

Figure1: Heterofusion of polymer nanoparticles

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[2] S. D. P. Fielden, *J. Am. Chem. Soc.*, **2024**, 18781–18796
[3] S. D. P. Fielden et al, *J. Am. Chem. Soc.*, **2023**, 5824–5833
[4] S. D. P. Fielden et al, *Nat. Commun.*, **2025**, 11701
[5] S. D. P. Fielden, *Trend. Chem.*, **2026**, 15–17

Zeta potential and electrophoretic mobility of uncoated and protein coated gold nanoparticles

Henry Peterson, Mengjun Jiao, Goran T. Vladisavljevic, Guido Bolognesi
University College London

University College London, Department of Chemistry, University College London, London, WC1H 0AJ, United Kingdom.

Due to their physical and chemical properties, gold nanoparticles (AuNPs) are widely used to study phenomena ranging from self-assembly to biolabelling and catalysis. The zeta potential of AuNPs is a key parameter for assessing the stability when dispersed in electrolyte solutions. A conventional method for determining the zeta potential employs electrophoretic light scattering (ELS) measurements of the particle's electrophoretic mobility μE , which is converted into the zeta potential ζ using Smoluchowski's equation, $\mu E = \varepsilon\zeta/\eta$, where ε and η are the permittivity and dynamic viscosity of the electrolyte solution. However, Smoluchowski's model is valid for dielectric particles and this neglects the highly conductive nature of gold. In this work, we investigate which electrophoretic mobility model, alternative to Smoluchowski's, best describes the electrophoretic behaviour of bare and bovine serum albumin (BSA)-coated AuNPs. Two models are considered: i) Henry's model for a conductive particle with constant zeta potential, and ii) Henry's model for a dielectric particle with constant surface charge. The experimentally determined mobilities were compared with theoretical predictions to assess the applicability of the two models. We demonstrate that the electrophoretic mobility of BSA-coated AuNPs can be described by a dielectric particle model with a constant surface charge, but only at ionic strength approximately above few mM, likely due to shielding by the protein corona. At lower ionic strengths, particularly for bare AuNPs, a conductive-particle model with constant zeta potential provides a more accurate description. Overall, these results show that accurate determination of AuNP zeta potentials requires a careful selection of the electrophoretic mobility model based on both particle surface chemistry and solution ionic strength.

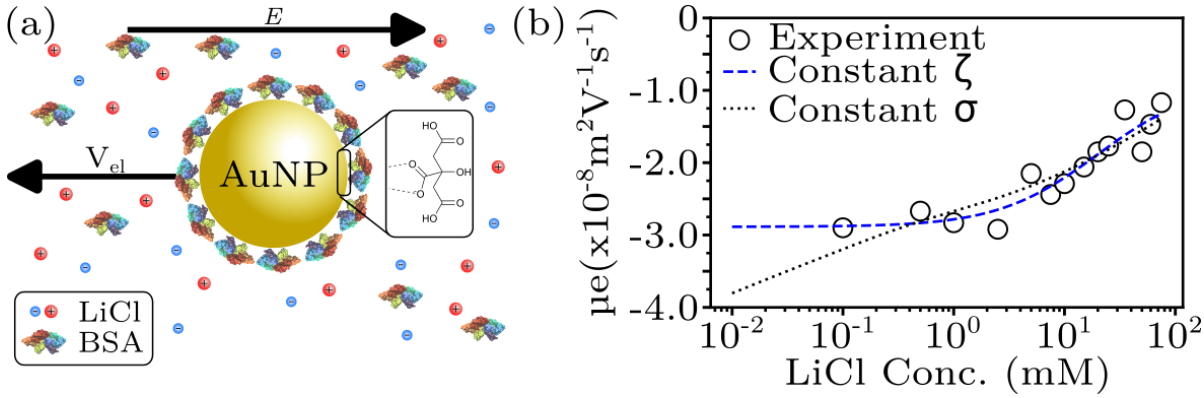

Figure 1: (a) Schematic of ELS analysis of a BSA-coated AuNP in a LiCl electrolyte solution. (b) Comparison of AuNPs electrophoretic mobility measured (symbols) and predicted by a dielectric particle's model with constant surface charge (dotted line) and a conductive particle's model with constant zeta potential (dashed line) as a function of LiCl concentration.

Composition of fluids in nanoconfinement

Lauriane Pierrot Deseilligny, Susan Perkin

Oxford University

Liquid–liquid phase separation is widely involved in many biological systems. Examples are the formation of protein condensates inside cells that regulate gene expression and cellular organization, and nucleation of amorphous carbonate in marine microalgae coccolith vesicles.

These phase separation processes take place in confined geometry, where steric constraints limit molecular mobility and the high surface-to-volume ratio increases the contribution of interfacial effects. Therefore, deviations from bulk phase behaviour are expected: the phase diagram of a confined binary liquid mixture can involve shifts in both the coexistence conditions and critical points. In electrolyte solutions, confinement can also lead to local enrichment or depletion of ionic species due to surface interactions and electrostatic effects. However, experimental characterization of confined fluids has been a challenge in the past due to the small separation distances limiting measurement precision and compositional resolution.

Using multiple-beam interferometry and refractive index analysis, we determine the composition of the equilibrium phases in phase-separated perfluoroalkane–hydrocarbon systems under varying degrees of confinement down to the nanoscale (Figure 1). We also apply this method to electrolyte solutions to measure local ion enrichment and to nano-confined lipid bilayers. The results support the relevance of this approach and motivate its extension to protein phase separation, membrane fusion, and solid–electrolyte interphase characterization in batteries.

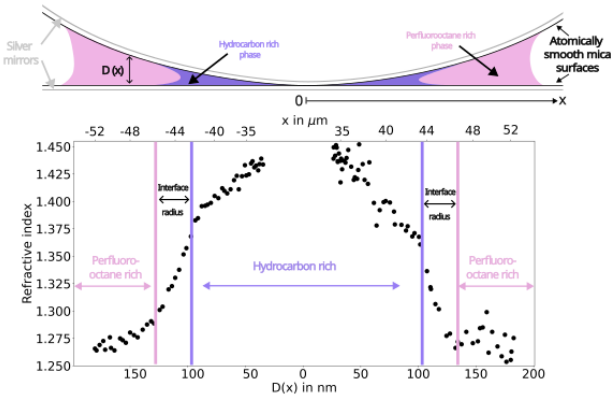

Figure 1 Refractive index profile of a phase-separated mixture of perfluoroalkane–hydrocarbon confined down to the nanoscale. At the top, a schematic illustrates the corresponding phases confined between a sphere and a plane.

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Diffusiophoresis and diffusioosmosis-driven dynamics of modified polystyrene colloids in long double-junction microchannels

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In previous studies, we introduced a double-junction microfluidic device that exploits diffusiophoresis and diffusioosmosis for size- and charge-based particle separation under continuous flow settings.[1] The device establishes a steady-state salt gradient perpendicular to the flow, causing particles to accumulate into two symmetric regions via diffusiophoretic and diffusioosmotic effects. In this work, we investigated the dynamics of particles in longer microchannels, whereby particle residence times are comparable to the characteristic time for salt diffusion. Scaling laws relating the width of the colloidal streams and the distance between particle focusing peaks to the residence time were determined. We also investigated the effect of particle and channel surface chemistry on the observed particle dynamics. We found that the direction and intensity of particle migration is highly sensitive to the presence of a protein layer either on the particle surface or channel walls, affecting both the particle diffusiophoretic mobility and the wall diffusioosmotic mobility. By leveraging this effect, we propose a strategy to fully separate protein-coated from bare particles. This approach offers a promising platform for point-of-care diagnostics, including bioparticle sensing, sorting, preconcentration, and analysis.

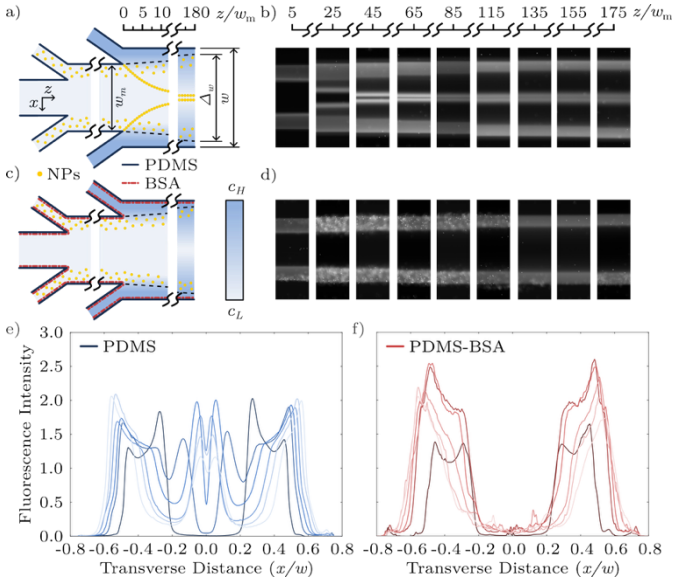

Figure 1: Panels a, b and e show, respectively, the experimental setup, micrographs and fluorescence intensity profiles of carboxyl-modified polystyrene particles in bare PDMS microchannels. Panels c, d and f show the dynamics of particles in BSA-coated PDMS microchannels.

References

Chakra et al., ACS Nano 17 14644-14657 (2023)

Modelling the motion of chemically-driven isotropic colloids and drops along a rigid surface

Nikhil Desai, Sébastien Michelin***

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*** LadHyX, Ecole Polytechnique, Institut Polytechnique de Paris, Palaiseau, France, 91120*

Chemically active drops are micron-sized "swimmers" that swim by converting ambient chemical energy into motion. Unlike Janus colloids these drops are physico-chemically isotropic and thus are not endowed by any intrinsic asymmetry. Yet, they swim via a nonlinear instability: the drops emit a chemical solute whose gradients drive interfacial flows which in turn affect the solute's distribution via convective transport. If solute diffusion is smaller than a threshold, then the nonlinear coupling between fluid flow and solute transport around the drop causes a spontaneous symmetry-breaking, leading to sustained interfacial flows and "swimming" of the drop.

Active drops typically have a density mismatch with their surrounding fluid, and hence they generally swim near boundaries. Yet, existing models ignore this fundamental feature and focus on active drop motion away from any bounding surface. We present here a mathematical model that bridges this gap and provide critical physical insight on the emergence of self-propulsion of active drops along a rigid wall. Using numerical simulations, it is shown that, perhaps counterintuitively, the presence of a rigid surface *enhances* the motility of the active drop. We attribute this behavior to an efficient rearrangement of the solute concentration gradients driving the drop, around a region on the drop from where they exert the strongest influence on the drop's motion.

Structure-property relationships in Pluronic/Hyaluronic acid micellar polycrystals

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Pluronics (PLs) are thermo-responsive amphiphilic copolymers utilized in applications ranging from depot injectable drug delivery, cosmetics to bioprinting [1]. Additives, such as polysaccharide polyelectrolyte hyaluronic acid (HA), are known to enhance the stability and mechanical strength of PLs [2,3]. Pluronic F127, a triblock co-polymer with two hydrophilic poly(ethylene oxide), PEO, blocks and a central poly(propylene oxide), PPO, block that exhibits an increased hydrophobicity with temperature is chosen for present study. At critical concentrations, the system is known to undergo transition from micellar solutions to micellar polycrystals with increasing temperature [4-7]. Polysaccharides with hydrophobic groups, such as HA, are known to interact with the hydrophobic core of PL micelles, and alter the rheology of the system [2,3].

The present work utilizes stress-controlled Optimally Windowed Chirp (OWCh) rheology [8] to investigate the time-resolved viscoelastic relaxation of Pluronic F127/HA mixtures during a rate-defined temperature sweep. Small angle X-ray and Neutron scattering studies (SAXS, SANS) reveal FCC-like arrangement of micelles 4within the grains (i.e. crystal domains), and a distinct influence of HA concentration on the lattice/ grain size at physiological temperature (37 ◦C). Time-resolved SANS during steady/ oscillatory shear rheology at this temperature indicated flow-induced structural changes, such as, the formation of HCP-like layers that undergo transient melting and recrystallization at higher strains/ shear rates. A strong HA-modulated shear banding was observed during Gap-resolved SANS along the flow gradient direction. The insights thus obtained are essential to interpret the structural hierarchy, and microscopic origins for macroscopic properties of such systems for relevant applications.

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Structure of Aerosol OT inverse micelles from neutron diffraction

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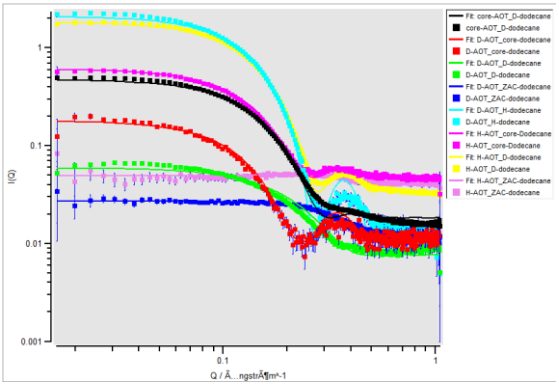
Aerosol OT or AOT surfactant (sodium dioctyl sulfosuccinate) is the archetypal stabilizer for microemulsions in nonpolar solvents, with a structure that has been studied over decades,[1] and continues to be studied to this day. Despite this ubiquity, there is nothing "special" about AOT for this purpose, aside from its chain structure, which gives optimum room temperature performance.[2]

As an extension of past research into AOT self-assembly in nonpolar solvents, I was awarded neutron diffraction beamtime to study AOT inverse micelles (D16, ILL). This experiment revealed the value in obtaining high-resolution diffraction data at Q values higher than typically accessible on a small-angle neutron scattering instrument. The measurement of this high-Q scattering proved valuable in guiding the data modelling, allowing me to obtain successfully co-refined data from 8 contrast variations (Figure 1). My geometrical modelling was consistent with previous proposed structures of AOT inverse micelles from SANS measurements using only solvent contrast-variation.[3] They used an analysis of the radius of gyration in different solvent contrasts to make a proposal of the packing of the inverse micelle core and the thickness of various regions (Figure 2). My neutron diffraction data validated this with geometric fitting, with greater certainty from the number of contrasts that can be fit. We see some of the same features in our neutron diffraction data: the large radius of the polar core from the unremovable waters of hydration and the highly solvated ends of the AOT tails (the final 2.4 Å in Figure 2) that cannot be detected by SANS or neutron diffraction.

As previously stated, determining the structure of AOT inverse micelles in nonpolar solvents has been an active area of structural research over recent decades.[1,3] For example, Kotlarchyk used contrast-variation SANS to determine the structure of the AOT inverse micelle,[3] and I have used SANS as the essential technique to determine the CMC for inverse micelle formation.[4] The example of my recent neutron diffraction time (D16, Figure 1) shows that there is still much to be learned using neutron scattering and diffraction.



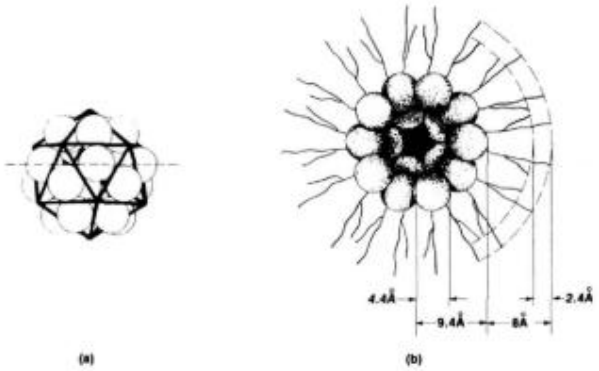


Figure 1 (left) Neutron diffraction data from AOT inverse micelles (100 mM) in *n*-dodecane (D16, ILL). These data have been co-refined to a core-shell sphere model. **Figure 2 (right)** Structure of AOT inverse micelles from SANS data. (a) Packing of polar heads in an inverse micelle. (b) The core and shell structure. From Kotlarchyk *et al.*[3]

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Poster Flash Presentation Abstracts

Diffusiophoretic Manipulation of Colloidal Particles in Viscous Media

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Diffusiophoresis, the motion of particles along a solute concentration gradient, provides a simple route for particle manipulation in microfluidic systems without external fields. While it has been studied extensively in aqueous media, its behaviour in more viscous environments remains less understood. In this work, we investigate the effect of increasing solution viscosity on the diffusiophoretic transport of charged colloidal particles in microfluidic channels under continuous-flow conditions. Experiments were carried out in polymer microchannels using polystyrene particles and a salt concentration gradient was established across the flowing streams, and particle distributions were analysed to assess the influence of solution composition on transport behaviour. These results demonstrate that solvent viscosity and composition play a crucial role in governing diffusiophoretic transport in confined microfluidic geometries. The study provides new insight into colloidal manipulation in viscous environments, with potential relevance to lab-on-a-chip applications involving biofluids, drug delivery media, and soft matter processing.

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Small-angle neutron scattering at the ISIS neutron and muon source

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Small-Angle Neutron Scattering (SANS) is a technique historically at the forefront of soft matter and colloidal sciences [1]. SANS can typically access a few Angstroms to hundreds of nanometres, which is a powerful technique for studying systems such as emulsions [2,3], gels [4,5], and particle dispersions [6]. Aside from colloidal science, SANS has found long-term interest in other soft matter applications, such as protein-lipid interactions, lipid nanoparticles, and food science, and in magnetism, where polarised neutrons can investigate magnetic materials.

The SANS group at ISIS has a suite of four instruments, three on target station 2 – Sans2d, Zoom, and Larmor, and one instrument on target station 1 (Loq). A benefit of using a pulsed neutron source, such as ISIS, is performing time-of-flight SANS (TOF-SANS) measurements, where a white incident beam, composed of a large band of neutron wavelengths, is collected with time-of-flight detection methods. This allows for a large dynamic range of length scales to be captured in one instrument configuration. These TOF-SANS instruments (Sans2d, Zoom, Larmor, and Loq) can access length scales from a few Angstroms to several hundred nanometres, instrument-dependent [7,8]. Larmor is a flexible instrument able to perform SANS and scattering techniques that use the Larmor precession of neutrons, such as spin-echo SANS (SESANS), to access larger length scales than conventional SANS (from nanometres to microns).

Aside from the suite of instruments, there are an assortment of sample environments, which allow various scientific applications to be supported, for example some rotating racks that can reduce sedimentation out of the beam. The kinetics of self-assembly or crystallisation processes can be investigated with stopped-flow rapid mixing. Structural changes induced under flow can be probed with rheology coupled to SANS (rheo-SANS). For studying phase behaviour, a selection of temperature-controlled and pressure-controlled environments are available, including a high-pressure cell for supercritical CO2. Finally, for magnetism studies, there are electromagnets and cryo-magnets that can be placed onto the instruments, with polarisation analysis on the data to separate magnetic and structural scattering.

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Crosslinked Polyester Latexes as Degradable Alternatives for Acrylate PSAs: A High-Solids, Solvent-Free Approach

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This work explores the development of crosslinked polyester-based latexes as degradable alternatives to conventional acrylate pressure-sensitive adhesives (PSAs). A three-step synthesis pathway was employed to produce functionalised latexes with tuneable adhesive properties. First, a low molecular weight polyester resin was synthesised via conventional polycondensation, using a modified recipe based on poly(butylene succinate-*co*-adipate) (PBSA), a biodegradable aliphatic polyester. This resin was then emulsified through a solvent-free catastrophic phase inversion process, yielding high-solids-content latexes (50 wt%) with a fine particle size (~200–300 nm). The parameters affecting the inversion process and particle size were systematically investigated to support the translation of this method across resins with varying chemistries and viscosities. The low molecular weight (Mw: 10 kg mol $^{-1}$) polyester, was lacking sufficient entanglement for adhesion, therefore additional crosslinking chemistry is required. We are unable to disclose the exact chemistry or nature of this reaction due to patent fillings. The influence of crosslinker ratio was studied through rheological and mechanical testing, revealing broad tunability in viscoelastic behaviour. A strong visual correlation between fibril formation and elongation behaviour and their effect on tack performance was also observed, underscoring the importance of degree of the branching in achieving effective adhesive properties.

Complexation and protection of dsRNA by pH-responsive block copolymers in varying pH and electrolyte conditions

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RNA interference (RNAi) is a natural cellular process that triggers targeted gene silencing. Double-stranded RNA (dsRNA) can be delivered into cells to induce RNAi for pest control applications to silence essential genes in selected pests only [1]. While cellular uptake of naked dsRNA is possible, polymer carriers can protect dsRNA from enzymatic degradation and facilitate its delivery to the cell across varying pH and electrolyte environments [2]. In this work, pH-responsive, hydrophilic diblock copolymers were synthesised and complexed with dsRNA targeting the *vha26* gene in *Drosophila suzukii* (an invasive fly that can reduce yield of certain crops by up to 30% [3]). Previous works tested similar polymer designs that were not responsive to pH with good results [4]. However, due to the different pH environments in *Drosophila suzukii*'s gut, adding pH-responsiveness to polymer design could allow for more efficient and controlled delivery of dsRNA. In this work, diblock copolymers consisting of a random PDMAEMA (PD) and quaternised PQDMAEMA (PQ) block and a PDMA block were complexed with dsRNA forming polymer-RNA complexes. The performance of these complexes in protecting and releasing RNA at different pH values was tested with gel electrophoresis (GE), fluorescence spectroscopy (FS), electrophoretic mobility (EM) and dynamic light scattering (DLS). Figure 1 shows results obtained with FS for different complex designs, indicating continued protection of dsRNA (retained reduced fluorescence) upon enzyme addition in an environment of 10 mM NaCl and pH 5.

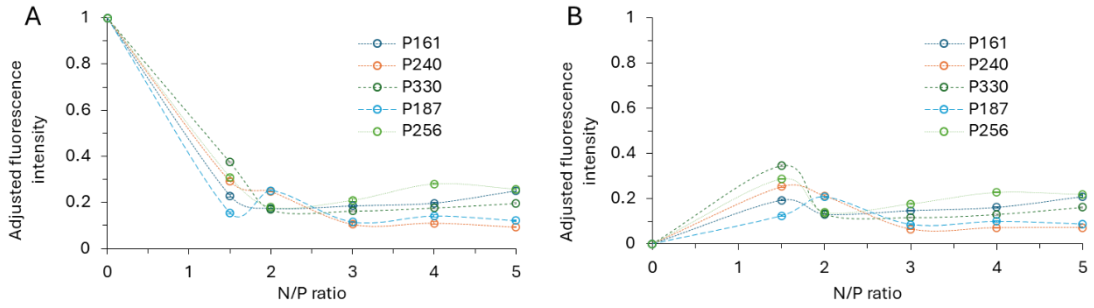

Figure 1. Fluorescence of different complexes with varying N/P (polymer to RNA) ratios at pH 5, with (B) and without (A) RNAse A enzyme addition. At N/P = 0 only dsRNA is present, and fluorescence is high. Polymer addition binds RNA phosphates to polymer amines, leaving fewer RNA base pairs to intercalate with fluorescent agent and reducing fluorescence. The legend indicates the polymer in each complex: P161: PQ120-b-PDMA161, P240: PD146-b-PDMA240, P330: PQ33-rd-PD104-b PDMA330, and P187: PQ58-rd-PD61-b-PDMA187.

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