IOP | Institute of Physics
Printing and Graphics
Science Group

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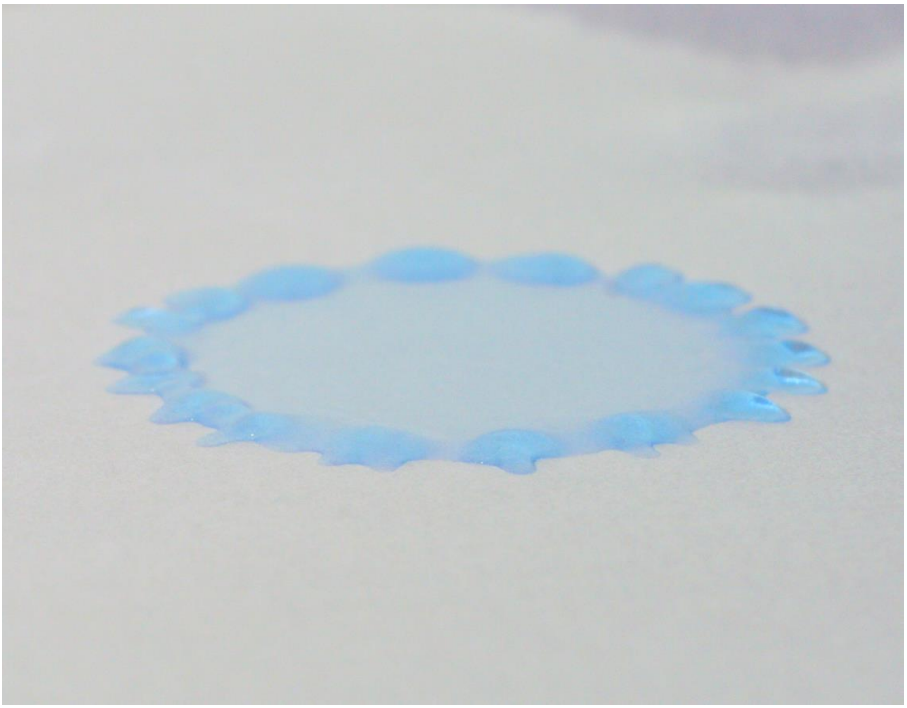
Cover image: Courtesy of Dr Andrew Edwards, Nottingham Trent University. A freeze-frame during a water droplet impacting on paper showing splash pattern and breakup of the receding lamella.



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Welcome and Message from the Chair

We are living through unprecedented times, with the impact of Covid-19 felt globally. Our small world has changed dramatically in past few months. It is my hope that this newsletter finds you safe and well in these troubling times.

The recent pandemic has shaken the foundations of our world, and the world of physics alike, with many events under postponement to encourage social distancing. Even so, a few trips were able to take place in the earlier months of this year, including visits to the printers of Physics World (Warners of Bourne, Lincolnshire), and to the National Printable Electronics Centre (Newton Aycliffe).

We hope that 2021 will see a resurgence in new and exciting events, with everyone able to get together and enjoy physics again. As such, we expect to run our annual student conference and look forward to the calendar for 2021, including, The History of Printing and Fluids. This Spring we also welcome Dr Andrew Edwards (Nottingham Trent University) and Dr Susanne Klein (UWE) as two new ordinary committee members and look forward to the new ideas they bring to the committee.

Emma Talbot
Chair, Printing and Graphics Science Group
September 2020

Committee Membership 2019-2020

Chair

Dr Emma Talbot
Base4 Innovation Ltd

Honorary Secretary

Mr Martin Gouch
FFEI Ltd
martingouch@hotmail.com

Treasurer

Dr Dilwyn Jones
Consultant
dilwyn.jones@outlook.com

Ordinary Members

Dr Feras Alkhalil
Pragmatic Printing

Dr Andrew Edwards
Nottingham Trent University

Dr Fouzia Ouali
Nottingham Trent University

Dr Susanne Klein FInstP
University of the West of England

Dr Gary Wells
Northumbria University

Dr Leszek Majewski FInstP
University of Manchester

Dr Ehab Saleh
University of Leeds

Dr Ronan Daly
Institute for Manufacturing,
University of Cambridge

Reports from Recent Group Events

IOP Printing and Graphics Science Group and East Midlands Branch visit to Warners Midland Printers

12 February 2020
Warners Midland Printers

At the date of the visit, the Coronavirus storm was still only on the horizon, but the meteorological storm Ciara had hit a few days before and left some floods. Fortunately travel was not disrupted, but there were many submerged fields visible from my train carriage. 10 people made it to Warners: 3 were PGS Group members and 5 East Midlands Branch members. Thanks to Fouzia Ouali for organising transport to bring students and staff from Nottingham Trent University. We were given a short introduction followed by a factory tour from Adam Lees and Michael Warner. We thank them and also Michelle Harris for organising the visit.

Warners Printers produce the IOP's monthly magazine, Physics World. They are located in Bourne, Lincolnshire, and employ over 200 people. They are a short to medium run printer (1000 to 500,000 copies) of magazines, catalogues and brochures. They are a successful family-run business, established in 1926. There is plenty to look at on their website, www.warners.co.uk, and you can also read about the visit of Kate Gardner (Physics World Content and Production Manager) in 2019 at https://physicsworld.com/a/behind-the-scenes-at-the-printer/.
Much of the desktop work to set up the page layout and other office jobs are in a large open plan area in an old brick and timber Maltings building – a very attractive work environment. We saw the plate-making equipment, and several sheet- and web-fed multicolour printing presses. Then we were taken into a recently-erected factory building, housing a brand new MAN Lithoman 3 64 page web press from Germany. We didn't see it run, but it was in the final stages of setup, calibration and operator training prior to handover. The Warners blog post for that day had a short video of it running paper and ink for the first time. Modern presses fold, cut, staple and stack the printed booklets. Warners also have separate machines for binding and other finishing operations, and can also mail out magazines individually wrapped and labelled.

The tour by Adam Lees was both fascinating and humorous, with anecdotes of the occasional disaster. Printers Ink is viscous and exceedingly messy! He was keen to stress the progress they have made in making their operation environmentally friendly: for example, sustainable paper sources, solar cells on the roof, and burning waste solvent vapour to cut emissions and produce energy. Hopefully the tour will have given the students and researchers some idea of how

their work on wetting, droplets, drying etc. helps define the processes that the printing presses run. Everyone enjoyed seeing some real printing machinery, and I had to leave to catch my train with the post-tour discussion still in full swing.

Report by Dilwyn Jones

IOP Printing and Graphics Science Group and NorthEast Branch visit to CPI, National Printable Electronics Centre

11 March 2020
CPI, National Printable Electronics Centre, Sedgefield

Wednesday 11th March was the day that the Institute decided to suspend its activities because of the developing coronavirus health crisis. We were able to go ahead with the visit because the directive was not announced until later in the day: one day later and we would have had to cancel! Our hosts, the Centre for Process Innovation (CPI) had procedures in place that enabled the visit to go ahead safely.

CPI has several sites in the Northeast. We visited the Newton Aycliffe site, around 10 miles north of Darlington, which specialises in flexible hybrid electronics, integration and laboratory testing. Among other things, we saw adapted roll-to-roll printing presses, and pick and place assembly to mount sensor chips on flexible printed circuits. At nearby NetPark in Sedgefield, various vacuum deposition techniques (including Atomic Layer Deposition) are used for the manufacture of thin film transistors, display backplanes, and the application of encapsulation and barrier layers to prevent water ingress. Our hosts, Simon Johnson and David Bird, gave us an hour-long overview of CPI activities and flexible electronics in particular. CPI was established in 2004, and is a member of the UK's High Value Manufacturing Catapult. It assists in the critical parts of innovation between invention and commercial production: proof of principle, prototyping and small production runs. For more, see their website www.uk-cpi.com.

The visit was organised jointly by the Printing and Graphics Science Group and the North East Branch of the IOP, because I conveniently happen to be on both committees! We had 1 from the Group and 4 from the Branch attending, along with 2 from the Yorkshire branch, 2 from other professional bodies and myself. Unfortunately, 5 people either cancelled or did not show up, probably because of workplace directives or concerns about coronavirus. Everyone found the tour fascinating, and we had to curtail the interesting discussion at the end to allow our hosts to get some work done! One attendee e-mailed me afterwards: "Thank you … for letting IOP members see some of the impressive facilities that CPI have

there. At times when the popular media is all gloom and doom, it is particularly good to see these pockets of UK enterprise. More so when it resides in the North East - where historically there has always been enterprise."

Report by Dilwyn Jones

Printing for the Future 2020

15-16 July 2020
Online Event

This year we ventured into our first experience of online conferencing with our student conference spread across two days.

The student prizes for best presentation were awarded to Damien J Leech (University of the West of England) and Regana Vasanthanayagam (University of Cambridge, UK). The winning abstracts are below:

Direct-writing and embedding of functional materials into construction materials to enable smart cities

Regana Vasanthanayagam[1], Ian Fausto Zanchetta Chittka[2], Chrysoula Litina[1], Maria Cristina Rodriguez Rivero[1], Javier Orozco-Messana[2], Abir Al-Tabbaa[1], and Ronan Daly[1]
[1]University of Cambridge, UK, [2]Universitat Politècnica de València, Spain

Control of 2D patterns of nanomaterials by inkjet printing has already shown the potential to create devices and functional surfaces for emerging product technologies such as transparent flexible electronics and printed sensors. Here we describe the embedding of functional 2D materials into the near-surface regions of composite construction materials, namely cement and ceramic tiles. Both mineral composite materials are important in architectural applications, so the delivered functions can be used to support initiatives in Smart Cities. These are challenging surfaces for controlled 2D material integration and have to-date been neglected from detailed functional printing research. These challenges will be discussed with a focus on two exciting and emerging examples. Firstly, we will report the challenges of integration of functional nanomaterials into the ceramic tile fabrication process, including compression, printing onto porous media and firing. Secondly, we will examine the integration of materials into cements at different stages of the formation process. We show here the importance of understanding the interdependencies between the advanced functionality of emerging materials and their associated manufacturing technologies.

Continuous tone relief prints in gelatin – The Woodburytype

Damien J Leech, Walter Guy, and Susanne Klein
University of the West of England, UK

Since its inception, halftoning has provided us methods of print that have high throughput and are easily reproduceable. However, as the complexity of our printing methods increase, we can instead turn our attention to continuous tone methods, where the tone varies smoothly and the feature size is no longer limited by the dot size. The Woodburytype is a forgotten 19th century printing technique that produces a photographic level of detail in a continuous tone relief print, using a gelatin film pigmented with carbon black [1]. We reverse engineer this process, using reflectance and spectroscopic measurements to build an optical model that determines the colour and lightness of a print height/pigment load combination. This seemingly simple system reveals itself to be a competition between a highly absorbent pigment and a highly scattering binder. We then extend this toward a full colour, multi-layer printing method and explored how other methods of layering translucent films can be used to produce similar optical effects.

[1] Leech, D. J., Guy, W., & Klein, S. (2020). The optical properties of the Woodburytype—an alternative printing technique based on a gelatine/pigment matrix. Journal of Physics Communications, 4(1), 015018, 2020. https://iopscience.iop.org/article/10.1088/2399-6528/ab6ed4

Continuous tone relief prints in gelatin, courtesy of Damien Leech, University of the West of England

Reports from Other Events

Under Pressure

5 March 2020
An exhibition by printmaking staff at the University of the West of England

The university of the West of England is heaven for printmakers. Not only it is home to the Centre for Fine Print Research (https://cfpr.uwe.ac.uk/), but also the School for Art and Design has facilities other institution can only dream of and could therefore attract top printmakers and top researchers from all over the world. Side by side you can find students, artists who have work in the Victoria and Albert Museum, chemists and physicists.

In March, just before the lockdown, the exhibition 'Under Pressure' showcased the work created by such a diverse community. It turned out that it was the last big private view before Bower Ashton Studios fell dormant. Of course, drinks in cyan, magenta, yellow and black and red, green and blue were served and no one did imagine then that it would take 5 months until life would return slowly but surely to the studios and laboratories. As printmakers we are used to work under pressure and will weather the new situation as well.

Report by Dr Susanne Klein, University of the West of England

Under Pressure reception courtesy of Dr Susanne Klein, University of the West of England

Under Pressure, courtesy of Dr Susanne Klein, University of the West of England

Under Pressure, courtesy of Dr Susanne Klein, University of the West of England

Forthcoming Events

London Imaging Conference

September 29-Oct 1, 2020
Online Event

http://www.imaging.org/site/IST/IST/Conferences/LIM/LIM_Home.aspx
Featuring innovative new research and case studies that impact the future of imaging science.

IS&T Printing for Fabrication 2020

12 – 22 October 2020
Online Event

https://www.imaging.org/site/IST/IST/Conferences/Print4Fab/Printing_for_Fabrication.aspx
Short courses will be run the week of the 12th October with a technical programme to follow between 19-22nd October.

28th Colour and Imaging Conference, CIC28

4-19 November 2020
Online Event

https://www.imaging.org/site/IST/Conferences/Color_and_Imaging/CIC2020/IST/Conferences/CIC/CIC_Home.aspx
While the conference will be online this year it is sure to include high-quality short courses, workshops, keynote talks, and a technical papers program.

Awards

PGS Group Awards

The PGS Group award two student presentation prizes each year at the annual Printing and Graphics Science Group Student conference. These prizes are open to all research students currently undertaking work at a university in the UK or Ireland, leading to a PhD or Masters degree, who present their work at the conference. Prizes of £50 and a certificate from the IOP are awarded for the two best student presentations.

The 2020 Student Presentation Prizes were awarded as follows.

Damien J Leech (University of the West of England) for his talk on “Continuous tone relief prints in gelatin – The Woodburytype”

Regana Vasanthanayagam (University of Cambridge, UK) for her talk on “Direct-writing and embedding of functional materials into construction materials to enable smart cities”.

Other Information

PGS Group on LinkedIn, Facebook and Twitter

The Group has pages on the LinkedIn, Facebook and Twitter social networking sites which are regularly updated with news items and details of upcoming events. We look forward to seeing you there.

LinkedIn

http://goo.gl/B0mds

We can be found by searching for the 'Printing and Graphics Science' group on LinkedIn or by following the link above. You will need to be a member of LinkedIn to view the page.

Facebook

http://goo.gl/vX0kC

We can be found by searching for the 'Printing and Graphic Science Group' on Facebook or by following the link above. There is no need to be a Facebook member to view the page.

Twitter

https://twitter.com/PGS_IOP

The PGS Group is now on Twitter @PGS_IOP.

Research Student Conference Fund

Applications are open for the Research Student Conference fund for up to £300 towards travel and attendance of international conferences and major national meetings. Applicants must be IOP group members during the course of their PhD. Applications are considered quarterly and should reach the Institute of Physics no later than 1 March, 1 June, 1 September or 1 December.
https://www.iop.org/research-student-conference-fund

This newsletter is also available on the web and in larger print sizes

The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

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Note; There is a print and E book version of this Newsletter. The (free on Smashwords) E book includes colour images though not all E readers support colour graphics.