

Institute *of* **Physics**

Printing, Packaging and Papermaking Group

NEWSLETTER

Spring 2005

Editorial

This year I have been involved in patents and intellectual property a lot in one way or another. Being a physicist I suppose that should not be too much of a surprise as I tend to be involved in the development of new things in the company but when the opportunity came to look after intellectual property strategy for the company came up I didn't step backwards fast enough and was volunteered army style. Nevertheless, contrary to my expectations it has been interesting. Given that a patents are a contract with the government of the country to hold a monopoly for around 20 years they are understandably, and rightly in my opinion, difficult to get and are very valuable.

In contrast though is the sharing of intellectual property normally needed for open standards setting. For a standard to work and be successful it needs to have a number of features but amongst them must be that it is cost effective to implement it. An open standard that requires everyone to license a piece of intellectual property at a price where everyone can not make a reasonable living from is not an open standard at all. Fortunately most open standards do not have this problem and the members have spent some time coming to an agreement to prevent this happening. It is normal for members to offer each other or standard implementers a "Reasonable and Non Discriminatory" license known as a RAND license thus enabling the whole community, implementers and users, to benefit from the good ideas behind the standard. A noticeable example of this that I have been involved in over the years is the ICC colour profile specification. Unfortunately there seems to have been a couple of cases over recent years for this "gentleman's agreement" not to work, although fortunately not necessarily in the PPP's field. Thus we need a new way to go forward. The CIP4 organisation, which sets the JDF standard, has been trying to do this. It is a difficult task as JDF and the stated goals of the CIP4 encompass a very large area and may intrude into areas of intellectual property companies will defiantly not be willing to give up so they have developed checks and safety measures designed to ensure that everyone is reasonably protected from rogue operators and yet able to produce a useful open standard. The work so far has been very successful and I think everyone involved is pleased with the progress that has been made and hopefully drawing to a successful conclusion. I believe once it is completed then it will form the blueprint for how future standard setting organisations should tackle this tricky issue of sharing valuable intellectual property and everyone benefiting.

Regards

Martin

Editor

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Committee News

The Group held its Annual General Meeting prior to the Inkjet Printing meeting at the Institute of Physics on February 2nd 2005. The Officers' Reports had been circulated previously and were approved at the meeting. Martin Gouch retired from the Committee, but we are grateful he is continuing to edit the Newsletter. Dr Philip Green of London College of Communications was elected as a committee member (he was previously co-opted), and Dr Nigel Sherman was re-elected as a committee member (to satisfy new Institute rules). Our 2 co-opted members, Andrew Hanson of NPL and Dr Joyce Townsend of Tate Britain, had their appointments ratified by the meeting.

Dr Bill Sampson, the Group Chair, has overriding commitments at the University of Manchester and has indicated he intends to stand down from the Chair as soon as a replacement can be found. At the next Committee meeting on March 16th, those present considered this and a possible relaunch of the Group. The process of agreeing the way forward for the Group is still under way with the whole Committee, and we do not yet have proposals to put to the Group as a whole. Nevertheless, the programme of Group events and awards will continue, as shown elsewhere in the Newsletter and on the Website.

If anyone has views on how the Group can move forward, and in particular, if anyone would like to join the Committee to help us provide a programme of use to its members, please contact the Honorary Secretary, Dr Dilwyn Jones Dilwyn.Jones@physics.org.

Committee duties are not particularly onerous. We normally hold 3 meetings each year, normally on the same day as a Group Technical Meeting or Student Conference. Committee members assemble speakers for Group meetings, organise the venue and publicity, and run the 2 Group Awards and the Website. We are particularly keen to cover new technology areas in printing, displays, smart packaging, direct writing and others. Travel expenses to committee meetings are paid by the Institute. Committee service is a valuable Professional Development activity, and helps to build a useful network of personal contacts. It should be possible to attend a meeting as an observer to find out what goes on before taking the step of joining.

So please get in touch if you are interested!

Reports on Meetings

Displays afternoon meeting (joint with Colour Group), 3rd March 2004

This was a well-attended meeting with a total of 55 people, of whom 8 were PPP Group members, 24 Institute of Physics members, 25 Colour Group members and 13 not affiliated to the organising bodies. There were 3 speakers who gave 5 interesting talks. In the Exhibition area the Colour Group displayed an exhibition.

A certificate was presented to Dr Eddie Yeadon in recognition of his long service on the Committee and as Chairman of the PPP Group.

Recycling Visit

Date: 15th July 2004
Venue: Aylesford Newsprint. Aylesford Kent
Report: Martin Gouch

Aylesford Newsprint hosted 2004's visit with a trip around their paper recycling plant, which was a very impressive operation. Aylesford Newsprint makes paper entirely from recycled newspaper collected from throughout the UK. Unfortunately the paper mill was being cleaned during our trip but we were still able to see the whole process from the mountain of collected waste paper being delivered, evaluated for suitability and fed onto the processing conveyor belts through the soaking towers where the ink is separated from the paper to the reels at the end of the paper mill winding up the paper and wrapping it ready for storage and distribution. Most interesting was the automated storage facility, which was storing reels on the racks and collecting them for distribution via the transit bay without a human in sight.

After the tour there were three short interesting presentations. The first talk was from Aylesford themselves describing the logistics of their operation and their attempts to recycle as much as they can including purifying the water used in the paper pulp making process and using the rejected pulp fibres to generate electricity in their own generator furnaces and attempts to use the ashes from the furnaces to manufacture bricks.

The second talk was from David Powlson of the Waste and Resources Action Program (wrap at www.wrap.org.uk) who explained the main types of recycling currently conducted in the UK. Paper, Glass and Plastics. Although in the UK, paper has a slightly lower collection rate than the EU average the utilisation rate is much higher. This high utilisation rate is main due to very high rates in some sectors such as newsprint, case materials and packaging. Improving the utilisation rate has some technical issues still to be overcome such as sludge reprocessing, flexographic deinking, tissue quality as old paper is not suitable for recycling and the use of adhesives in some packaging. Glass recycling in the UK has a UK related problem of an imbalance in the colour of glass being recycled and the colour of glass required. We generally export clear glass in the form of whisky bottles but import green glass in

wine and beer bottles. With a recycle rate of 38%, and improvements on the way, it is expected that at least 400,000 tonnes of glass will be surplus by the end of 2008. Wrap are looking for alternative markets for green and mixed glass. This markets include water filtration media, fluxing agents for bricks and sanitary ware, additives in concrete products, grit blasting, foam glass, glass fibre and sports turf. The third market for recycling though is plastic but this has a problem in that plastic is light and targets for recycling are usually measured by weight. The phrase "No landfill site has been shut because it is too heavy" was used. It is also difficult to recycle plastic because of the wide variety of polymers types and the need to have very high purity of polymer type during the recycling process. The addition to the problem of a wide variety of colours does not help either so developing a sorting process is a challenge. We have for instance 20,000 bottles per tonne of waste but we want to produce 1 tonne/hour at greater than 95% accuracy. The processes being used is IR and spectroscopic sorting, grinding, washing, density sorting and finally drying. Film recycling on the other hand is relatively easy because of low levels on contamination.

The final talk was presented by Peter Broodcyke of ECR consultants who are looking at methods of recycling MDF. Although MDF is in itself mainly a recycled product the cut offs from product manufactured from MDF is not recycled but discarded. ECR are looking at ways of breaking down this new MDF which is currently wasted. The process under development is to use a combination of steam, pressure and water to break down the structure of the MDF. The MDF is placed into an autoclave, current size 18m x 5m, and then the autoclave is evacuated to extract the air from the spaces within the MDF stack. The autoclave is then filled with steam under a pressure of 2bar. The pressure is then cycled by holding for a while, evacuated and then repeating the cycle. This then produces a material which is suitable to be reused in the manufacture of a new board similar to MDF. Future developments are to look for methods to use the produced material in a paper making process. The main obstacle for this is that the produced material still has a high level of resin which needs to be removed. Various techniques for removing the resin which have been tried include the use of formaldehyde, UFR and an enzyme process.

Student conference 2004

Date: October 2004
Venue: University of Wales
Report: Phil Green

In October we hosted the second postgraduate student conference from universities around the UK with an interest in Printing, Packaging and Papermaking. This followed from last years inaugural event and we were again pleased about the quality of the presentations. Like last year there was over thirty attendees. Here are abstracts from the papers presented at the meeting. If anyone has any further interest in any one of the papers then please either contact the individuals at the universities or contact myself, Martin Gouch, details after the editorial.

A method for colour management on non-paper translucent media

Efrat Sharon, School of Printing and Publishing, London College of Communication

The relationship between the colour and the translucency/opaqueness attributes of the printed media is of current interest in industrial and graphic arts applications. In today's growing demand for unique marketing concepts and higher production quality, while many individuals and corporates are seeking solutions which are beyond the standard supplies, a wider range of materials is being used by print service providers; however, there is very limited information about quality control metrics for using a whole range of new media for printing.

The presented project is researching a sample range of translucent materials for the development of a practical model for correction and prediction of measurement on range of backing colours, taking into account the effect and limitations of sample backing on measured colour. Different aspects were taken into consideration in respect to measurement variables, while measurement geometry, surface and internal media scattering, substrate opacity and more were analysed. The intention was to develop a model that will allow measurement of colour using standard measuring tools such as a spectrophotometer, with standard white backing, and apply a correction method that predicts the measurement results the way they would have been measured on different backing. The objectives were:

1. To determine whether reflective measurement on white backing can be used to predict and simulate measured colour on other specified background for translucent media.
2. To check if reflective measurements sufficient to model.
3. To research phenomenon of light scattering within the substrate and its effect on measurement.

Texture mapping

Zhaohui Wang, Department of Colour Polymer Chemistry, University of Leeds

Two texture mapping algorithms were developed in order to preserving the gloss for on-screen texture simulation. Ten satin and five button samples in different colours were investigated in this study. These samples were captured by a high performance digital camera. The template profile, which was used to describe the statistical colour distributions on images, was chosen by using the method that introduced in this study. The simulated images were displayed on a calibrated CRT monitor. A psychophysical experiment was carried out by ten normal colour vision observers on judging the performance of five methods (three from previous work and two from this research) in a 7-point category scale that ranged from complete mismatch to perfect match. The results show that the two approaches developed in this study have an advantage on keeping the gloss.

Measuring gloss

Wei Ji, Department of Colour Polymer Chemistry, University of Leeds

The perception and measurement of gloss is an important part of the concept of appearance measurement. This paper describes the comparison between data derived by 20 observers who each scaled the perceived gloss of a set of 84 neutral and coloured test samples, and measurements of those samples made using three different instruments. Two gloss meters were used: a conventional instrument and a new instrument that uses a green LED as illuminator and a linear photodiode array as detector, and the results were found to be similar.

The relationship between the visual scaled data and the measured gloss values could be described by a three-part linear fit or, with a higher correlation, a cubic function. The third instrument was a sphere-based spectrophotometer that was used to make measurements of the samples in both specular included and specular excluded mode. The difference in luminance factor, delta Y, between values calculated from these two sets of measurements was found to give a better linear correlation with the observer-scaled data. The reflection haze of the samples was also measured and compared with the visual gloss data.

Issues in digital camera characterization

Pancham Singh, School of Printing and Publishing, London College of Communication

The large format camera was common in the graphic art industry. Currently scanner has replaced them. Current advancement in the digital camera and CCD imaging chip technology once again draws the focus of digital graphic art industry.

In this presentation issues related to camera characterization will be discussed and a new algorithm will be explained. It will include correction for non uniform illumination that was carried out by acquiring a white card in a camera set-up using a Leica Digilux-2. The card was smooth and free from surface defect such as marking, creasing, bending. Later a Gaussian filter of diameter 10 was applied to overcome the surface defect (caused due to paper fibres) and noise due to camera. Macbeth colour checker (24 patches) was placed on to the white card and acquired. The matlab function was employed to correct for the non uniform illumination in the first stage. Later a matlab function was employed to linearise the individual channel response. Characterization was carried out using polynomial regression technique and the error was found to be well below the just noticeable difference for third orders polynomial regression. Later a very similar procedure was carried out using SG colour checker chart. The process of characterization was extended using three dimensional lookup tables with geometrical interpolation technique that showed expectable result and it was able to predict colour that were out of training set.

Polynomial transformation approach in LCD colour monitor characterization

Youn J. Kim, Department of Colour Polymer Chemistry, University of Leeds

Characterisation modelling has made a considerable number of advances in the last few years. The general approach of the models was to find more accurate analytical relationships between monitor input signal and output luminance, and compensate for some inherent artefacts such as inter-channel cross talk, non-constant chromaticity, leakage light, etc. They have been progressed about as far as they can, and that further advances will require improvements in terms of accuracy and reversibility, etc.

This study aims to perform forward LCD colour monitor modelling by means of polynomial transformation. This is a one step process that converts monitor input signals to output colorimetric values. It was assumed that monitor output luminance values are linearly changed by change of input signals. That is because the relationship between monitor's typical gamma curves and functions higher than second order is linear. Third, fourth, and fifth order functions were tested and square root terms were inserted in order to enhance the model accuracy for dark colour gamut.

This method needs a set of training and testing data. While three-dimensional look-up table (3D LUT) models need a significant number of measurements, up to two hundred measurements for the training data set were sufficient in this model. For the training set, three data sets of RGB values were created. The first was a regularly sampled RGB colour gamut made up of a 5 x 5 x 5 grid (a combination of 0, 64, 128, 192 and 255). The second set was five equally stepped greys in digital counts from 0 to 255 for each channel. The third set was sampled to check model performance for the dark colours and was made up of a 4 x 4 x 4 of digital counts from 0 to 24. For the testing set, another set of 5 x 5 x 5 RGB grid (a combination of 50, 100, 150, 200 and 250), a set of equally spaced RGB ramp colours for each channel (a combination of 0, 50, 100, 150, 200 and 250) and a combination of 4 x 4 x 4 grid for dark colours (a combination of 0, 7, 14, 21). As a result, both of the training and testing errors plummeted,

as polynomial model complexity increased. In addition, square root terms contributed to significantly enhance the model accuracy for the dark colours. The median of training and testing errors were $0.1 \Delta E_{ab}^*$ and $0.4 \Delta E_{ab}^*$, respectively.

Volume and roughness characterization of an engraved cell in gravure printing

Davide Deganello, Welsh Centre of Printing and Coating, School of Engineering, University of Wales, Swansea

In gravure printing the engraved cell has a dominant role in the printing process. Accurate characterization of the cell, both in terms of geometry and internal surface roughness, is essential for the understanding and improvement of the process. White light interferometry has enabled the generation of a reliable 3D profile from which different physical characteristics of the cell can be defined.

This presentation deals with two aspects of the cell characterisation using white light interferometry: cell volume and cell roughness. A robust and accurate methodology for the measurement of the volume, defined as the quantity of a fluid necessary to fill the cell up to the cylinder surface, is presented. A new technique has been developed that enables the study of roughness of the walls inside the cell. This accommodates the effect of misalignment on surface characterization using white light interferometry.

Modelling the relationship between image colour and visual assessment

Kristy Leeming, School of Printing and Publishing, London College of Communication

Via psychophysical analysis and scaling methods this project looks at the relationship between measured colour differences and overall image acceptability. The visual algorithm and image quality model sections of the image quality circle are formulated using the prints and score data from the IFRA INCQC 2004 jury evaluation. The presenter has used automated methods to attain a series of measured points from the prints of the INCQC evaluation in order to establish their image colour. By looking at this series of measured points with regard to colour difference, subject and dependant colour attributes, the project aims to ascertain the minimum number of points required to be able to characterise perceived image quality.

A method to derive local colour difference tolerances in complex images

Boris Oicherman, Department of Colour Polymer Chemistry, University of Leeds

Development of colour management technologies and device independent workflow has introduced another kind of colour shifts in images - local ones: different colours in an image can be reproduced with different degrees of accuracy. These kinds of colour shifts can be introduced by gamut mapping and gamut compression algorithms, or characterisation inaccuracy. The reported study aims to define the methodology of evaluating tolerances of this kind of colour difference in images.

A concept of image colour centres is proposed, and methodology of practical implementation of this concept in experiments with local colour differences in images is described. The methodology includes conceptual definition of image colour centres, image region of interest, image content and colour context and methods for testing their effect on perceived colour difference.

The feasibility of the proposed methodology was tested in a pilot psychophysical experiment. The results show that significantly lower threshold values can be expected for local colour differences in images than for global ones; these thresholds were found to be of the same order as the ones reported for discrete colours. Symmetry of acceptability and perceptibility thresholds magnitudes cannot be assumed for opposite directions of hue differences. The results suggest that image content and colour context are both likely to affect the magnitude of perceptibility and acceptability of local colour differences, however, the data from the pilot experiment is too limited to generalise the result.

NOT PRESENTED

Consistent colour in offset can decoration

John Cherry, Welsh Centre of Printing and Coating, School of Engineering, University of Wales, Swansea

Can decoration uses non-process colours. Colour variation through a print run will be caused by the variation in ink film thickness.

In order to reduce the effect of any colour variation brought about due to the natural variation in ink film thickness, the ink film thickness is maintained at a level where the colour is saturated, yet cost and quality are not compromised.

Gravimetric and optical methods were used to establish the optimum ink weight for can decoration. Using this standard ink weight, it was then possible to prepare a specific database for a formulation system, allowing future ink formulations to be produced at this consistent ink film thickness.

Inkjet Printing

Date: 02 February 2005
Venue: IoP Headquarters, 76 Portland Place
Report: Andrew Hanson

The meeting was held jointly with the Colour Group (GB) [www.colour.org.uk], took place at Institute of Physics HQ in London and was well attended by about 80 members and non members.

Droplet formation and spreading in inkjet printing

Bill Baxter, Managing Director, IncaDigital

Bill's company has been running for 4.5 years and makes big £450k printers weighing 3.5 tonnes. He described how Inkjet's first technology was 'continuous' with electrostatics steering ink droplets either onto the substrate, or into a gutter for recycling. The newer 'drop on demand' method achieves higher quality. IJ technology is in active development with about 10 related patents filed per day.

Desk IJ printers heads are cheap (£15), heating watery ink costing £3k-£4k a litre until a steam bubble explodes 3-10 picolitre drops from the nozzle 20,000 times a second. With £10 billion R&D spent to date, it is a reasonably mature technology with some work still to do on head improvements.

Industrial IJ printer heads cost about £1k and use different methods to eject much less watery inks - even solids - which may be UV cured. Technological evolution here is still in ascendancy.

Organising 400 million drops per second uses high data rates, the most recent printers control 1,400 million drops per second. A raster image processor converts images to CYMK bitmaps and clocking is synchronised to a motion that places drops to better than 10 micrometers accuracy on paper travelling at 2 m/s.

The understanding and measurement of much of the fundamental physics of IJ printers is beyond human ability - the dynamic viscosities involved equate to destroying surface tension at a rate of 1 square km per second. There are many challenges, in particular in diminishing effects of 'satellite' drops following the main drop. Poor understanding of the physics means that QC of ink can fail as it involves properties that can only be tested with a printer. A recent EPSRC £2M project is addressing some of these issues.

Bill presented several examples of prints showing the versatility of the method - printing glorious colour onto media as diverse as paper, plastic and wood.

Ink Jet Printing for Industrial Applications

John Scott, Patterning Technologies Limited

John spoke about printing things other than pictures, and on integrating machines and

fluid processes, particularly in etch masking, medical, electronic and display applications.

The physics problems mentioned by the last speaker were expanded, as was the reliance on a largely empirical approach to solution. Print quality depends on drop formation and substrate placement accuracy. Tricky for a method which ejects materials as diverse as etch resists for PCBs, transparent conductors (which are almost as good as more traditionally used ITO), gold and silver conductors heated to 400 DegC, and delicate biosensor enzymes.

The potential benefits of using this method is replacing of advancing beyond other techniques is staggering. IJ can reduce a 6 stage photolithography process to 3 stages (or less) with less material costs and waste. It is possible to form microscopic 3D surfaces, and potentially electronics. The manufacture of displays is an application area proving the technology's value in electronics - print resolution can achieve 100 micrometer tracking gaps in printed electronic circuit boards. Other potential applications include solar panels, Radio Frequency ID systems, micro lenses, tactile displays and controllers, scratch resistant coatings and nanotechnology.

The future prospects include larger areas of print, new print head technologies, improved grey-scaling, and better placement accuracy. All these will lead to an even greater range of 'inks' which can be handled and thus a wider range of applications.

With a system promising less process steps, high flexibility and lower operating costs, IJ enables nothing less than a direct write revolution!

John Scott has kindly let us publish a copy of his slides which includes some interesting pictures and diagrams.

To view the slides click [here](#)

Colorimetric Inkjet Printing of Paintings

Dr John Cupitt, The National Gallery.

The Print On Demand system at the National Gallery is unique. Some other galleries offer printing services, but from transparency originals rather than colorimetric digital photographs. It enables visitors to examine the entire gallery collection on a computer monitor, search by terms (such as artist, period, or paintings containing animals), and print, there and then, a high quality (200 dpi) UV stable print for as little as £10 (for A4, £20 for A3 and £25 for A2). It has been very popular, bagging £2,500 per week profit, and supplementing (rather than diminishing) existing poster and postcard sales.

It took 3 extra full-time staff 2 years to facilitate the photography of the 2,500 pictures in the collection (5 a day). The images were mostly made using a 10,000x10,000 pixel camera capturing taking 160 seconds per image. The most recent version of the camera has been 'commercialised' by Sinar. The pictures are stored as 12 bit CIELAB images under Standard Illuminant D65. The image is translated into a PDF file containing an sRGB jpg, Fortuitously the colours of all paintings fit within the sRGB

gamut.

There are several colour transforms involved - including the transition from Illuminants D65 to D50. Following fine tuning using 3 paintings, the final original painting to print colour match is good to about 3-4 (worst case 8) Delta E.

There are several advances planned including the provision of POD kiosks outside the shop (and even by worldwide web), the ability to print on different substrates such as watercolour paper, customer controlled image cropping, multispectral imaging to reduce metamerism, and the use of 3D printing to give the impression of textured paint.

It is human nature to be contrary. There is a 4% complaint rate from the public who are not impressed by the high accuracy colour reproduction but would prefer a more 'cheery, colourful, chocolate box' style image. It is ironic perhaps that most frequently printed picture by a process which strives for colorimetric accuracy is of 'The Virgin and Child with Saint Anne and Saint John the Baptist' by Leonardo da Vinci, an image which is monochrome.

John made himself very popular by handing out many free samples - off-casts as part of his work, though to all but a few artists who claimed they could see 'issues' stunningly high quality representations.

Dr John Cupitt has also given us a copy of his slides.

To view the slides click [here](#)

The physics of inkjet and its use in some science-related applications

Robert Harvey, Xaar

Perhaps it was Lord Kelvin who started it all by registering a patent whereby electrostatic forces controlled ink flow. Robert described the three head processes as continuous, the electrostatically steered ink method capable of up to 200 dpi and 1 m/s, bubblejet - using thermally ejected droplets on demand with up to 1 billion firings per nozzle lifetime, and piezo with 100x the lifetime of bubblejet, and capable of delivering a wider range of 'fluids' at up to 110 pages a minute, full colour, with inks cheaper than toner.

John showed how stroboscopes revealed satellite drops (mentioned previously), and described how classical bulk modelling is used in the absence of better physics. He showed several advances such as the employing successive drops to obtain a grey scale, laser technology in making nozzles down to 18 micrometer diameter, and the use of acoustic waves to assist in ink management and firing.

Yet more applications were shown - Inkjet is used to dispense of microscopic biochemical assays in tests involving matrices of different reagents; electronics with up to 10 layers of conductors and insulators have been printed; fuel cells made;

pharaceutical doses in pills well controlled by a printing process, and manufacture of tailor made bone implants and skin dressings.

The future needs to consider other marking and deposition techniques to compete with laser and inkjet.. There are still major issues in understanding actuators and fluid jetting properties rather than the present rather black-art approach.

For many years now the offset litho press has been king in high volume printing. Whilst the newest inkjet technology can only print at about a quarter the speed of litho, it can, in principal, print every page differently.

AGM

The AGM was held this year at the Inkjet meeting. The following is the draft unapproved minutes of the meeting.

Minutes of the 19th Annual General Meeting held at 13:30 hrs on 2nd February 2005 in the Guthrie Room of The Institute of Physics, 76 Portland Place, London

Present: Dr. Bill Sampson (Chair), Dr Dilwyn Jones (Hon. Secretary), A Hanson, M Gouch, E Yeadon, R Thompson , P Lee, N Shepherd, N Campbell, J Townsend, P Green..

1. APOLOGIES FOR ABSENCE

Apologies were received from N Sherman.

2. MINUTES OF THE LAST MEETING

The minutes of the 18th Annual General Meeting were accepted as a correct record and signed by the Chairman.

3. MATTERS ARISING

None.

4. CHAIRMAN'S REPORT

This report concerns the year since the last AGM of the Printing, Packaging and Papermaking Group, held on 28th October 2003 at 76, Portland Place. At that meeting, Prof. Bob Thompson resigned the Chair of the committee after serving in that capacity for two years; Dr Bill Sampson, author of this report, replaces Bob as Chair. Over the course of the year, the committee has welcomed Dr Phil Green and Dr Joyce Townsend as co-opted members and has co-opted Mr Andrew Hanson and Mr Martin Gouch onto the committee after completing their periods of service as regular members; Dr Eddie Yeadon, former Group Chair, retired after many years dedicated service.

On the same date as the last AGM, the Group held its second Student Conference. The meeting built upon the success of the inaugural event held in 2002, and we now consider it to be a firmly established feature of our annual calendar of events. The audience of 36 attendees heard presentations from eight postgraduate students representing four UK universities who discussed their research relevant to the interests of Group members. The event was closed with the award of the Group's Annual Prize to Dr Justin Bradley, a post-doctoral researcher working in the Materials Science Group of the London College of Printing, for his work on the polarity and wettability of water-based printing inks.

The Annual Prize, the student bursary and the student conference have been established over the past few years to ensure that young physicists working in areas of

interest to our members were aware of the Group and the Institute. Although we did not receive any submissions of sufficient merit to award the bursary this year, we sense that our efforts are beginning to demonstrate a measure of success and are aware of a small number of new members having joined the Group and note that these new members are regularly attending our events.

During March, the Group held a joint meeting with the Colour Group on the subject of developments in display technologies. The meeting was exceptionally well attended with over fifty delegates enjoying the talks and demonstrations. At the same meeting, the Group presented Dr Eddie Yeadon with a certificate in recognition of his contribution to their activities.

In July, the Group visited Aylesford Newsprint in Kent for a tour of their facilities and for a technical meeting at which speakers discussed current issues in recycling of materials used in printing, packaging and papermaking. The final activity in the period of this report was the Student Conference held in November at the University of Wales, Swansea. The delegates enjoyed a full programme of high quality presentations made by students from four universities.

In the coming year, we look forward to continuation of the level and quality of activity seen in recent years and are developing a programme of meetings for 2005.

5. HON SECRETARY AND TREASURER'S REPORT

Group membership has continued to fall from 97 to 91 currently. Measures are being taken to improve publicity for meetings, which will hopefully reverse this trend.

It had been recognised for some time that the Group's website is out of date and not very helpful to members or others interested in our activities. A basic web page was put in place in October, and it is planned to add more technical content over the next year.

In 2004, the Group held meetings on "Displays" on March 3rd (joint with the Colour Group), "Recycling" on July 15th, as part of a visit to Aylesford Newsprint Ltd, and the Student Conference on November 11th. We are particularly grateful to the University of Swansea and Dr Tim Claypole for hosting this event.

The Group Committee met on March 3rd, July 15th, October 7th and November 11th (the last one was inquorate). At the March meeting, Martin Gouch and Andrew Hanson were co-opted back on as they were not eligible for re-election at the October 2003 AGM. At the same meeting, Dr Phil Green of London College of Communication was co-opted, especially to co-ordinate the student conference. In the July meeting, Dr Joyce Townsend of Tate Britain was co-opted in order to join the organising team for the repeat of the International Conference on Preservation and Conservation Issues Relating to Digital Printing and Photography in 2006. The Institute has revised the Constitution for Groups from 1st January 2005: the main effect is to change the maximum length of service of officers and committee members, in particular limiting the total service in any capacity to 9 years. The Committee hopes therefore that more volunteers come forward to help run the Group in the future.

The group received no suitable applications for the Student Bursary of £500. It was decided not to chase late applications to reduce the risk of a group overspend. Owing to a misunderstanding, the publicity for the annual Prize of £300 was unfortunately not sent out, so that too was not awarded this year. The Group Newsletter was sent out in January: thanks go to Martin Gouch, the editor.

The group's current balance on November 30th was £1443, with an outstanding payment of £86 to be made. The end of the year figure should be £1357. The balance is down from £1882 at the end of 2003: this fall is in line with the Group's policy of running student events and awards to promote the subject by spending the accumulated surplus judiciously. Financial summaries for 2003 and 2004 follow.

PPP Group Finances 2003		Credit	Debit	
			Plan	Actual
balance @ 1 Jan 2003		3297.56		
Group budget March 2003		2136.00		
Electrostatics meeting Jan 03	expenses		500	262.87
Committee meeting Jan 03	expenses		350	294.14
	catering		50	58.36
Congress April 03	catering		1000	0.00
	expenses		1500	0.00
student project sponsorship May 03	annual bursary		500	500.00
UMIST meeting May 03	catering		300	0.00
	expenses		500	226.09
Newsletter	printing		50	75.33
	mailing		100	30.80
Committee Meeting Sep 03	expenses		350	88.78
	catering		50	40.60
Student Conference Oct 2003	room		200	315.00
	speakers expenses		500	570.90
	mailing		100	59.66
	catering		500	467.40
	committee expenses		350	261.25
PPP Prize Oct 2003			300	300.00
TOTALS		5433.56	7200	3551.18

Dec 2003 Balance Carried Forward

1882.38

Note: this figure is £45 higher than the amount recorded by the Institute, as an item incurred elsewhere was incorrectly debited. This was corrected during 2004.

PPP Group Finances 2004		Credit	Debit	
			Plan	Actual
Opening balance		1882.38		
Group Budget		2154.00		
Newsletter	printing		80	102.08
	mailing		35	34.80
Displays Meeting Mar	room		200	197.00
	mailing		100	32.54
	catering		60	56.25
	committee expenses		350	287.21
	speaker expenses		100	0.00
student bursary May 04	annual bursary		500	0.00
Aylesford visit and recycling Meeting	speakers' expenses		500	202.40
Jul-04	mailing		100	32.03
	committee expenses		350	203.07
	catering		0	
Committee Meeting Oct 04	expenses		350	265.90
	catering		50	58.00
Student Conference Nov 2004	room		0	0.00
	speakers expenses		800	627.85
	mailing		100	37.93
	catering		500	201.25
	committee expenses		350	340.70
PPP Prize 2004			300	0.00
TOTALS		4036.38	4825	2679.01
Balance at year end		1357.37		

6. ELECTION OF OFFICERS AND COMMITTEE MEMBERS

The following were elected unanimously as Committee members:

Dr Philip Green (London College of Communication). Proposed by Dilwyn Jones and Neil Shepherd. Election of previously co-opted member.

Dr Nigel Sherman (Videojet Technologies Ltd). Proposed by Neil Shepherd and Dilwyn Jones. Re-election to satisfy Group Constitution

The continuing service of the following co-opted Committee members was ratified unanimously by the meeting:

Dr Joyce Townsend (Tate Britain). Represents the Institute of Conservation Science, and is co-organiser of the Conservation Issues conference.

Dr Andrew Hanson (National Physical Laboratory). Completed the maximum term of elected service allowed by the Constitution. Represents the Colour Group [UK].

Dr Martin Gouch retires from the Committee after 6 years service. He was thanked for his contribution.

Dr Bill Sampson (Chairman), Dr Dilwyn Jones (Honorary Secretary and Treasurer), Peter Lee, Professor Bob Thompson and Neil Shepherd continue to serve.

7. ANY OTHER BUSINESS

The Chairman noted he has overriding commitments at UMIST and asked the committee to consider a replacement chair before its next meeting. He also noted that most existing committee members have limited time to devote to the Group, and it has proved difficult to generate interest from the Group in serving on the committee.

It was agreed that the Committee would consider the future of the Group at the next meeting.

It was noted that there are now possibilities for remote participation in committee meetings, either simple teleconferences or using software in addition.

The meeting closed at 13:50 hrs.

Bill Sampson,
Chairman, 3Ps Group.

Dilwyn Jones,
Hon. Secretary, 3Ps Group.

Committee Members 2005

The current committee members (2005) are named below. All correspondence should be addressed to the Honorary Secretary, Dilwyn Jones. If you are not a member of the Institute of Physics and would like to join, please go to [online membership application page](#). If you are a member of the Institute of Physics and you wish to join the Optical Group, please call the IOP Membership Department (via the IOP Main Switchboard at +44 (0)20 7470 4800).

CHAIR:

Dr Bill Sampson
University of Manchester
E-mail: w.sampson@umist.ac.uk

HONORARY SECRETARY/TREASURER:

Dr Dilwyn Jones
Consultant
E-mail: Dilwyn.Jones@physics.org

ELECTED MEMBERS:

Dr. Nigel Sherman
E-mail: nigel@woolpitshermans.plus.com
Student Bursary

Peter Lee
Liaison with Institute of Printing

Prof Bob Thompson
London College of Communication
E-mail: r.rcthompson@btopenworld.com
Preservation and Conservation Issues in Digital Printing and Photography Conference
Organiser

Neil Shepherd
Toppan Printing Co. Ltd
E-mail: shepherd@toppan.co.uk

Dr Philip Green
London College of Communication
E-mail: green@colourspace.demon.co.uk
Student Conference

CO-OPTED MEMBERS

Andrew Richard Hanson
National Physical Laboratory
E-mail: andrewhanson@npl.co.uk
Prize, Liaison with Colour Group

Dr Joyce Townsend
Tate Britain
E-mail: Joyce.Townsend@tate.org.uk
Liaison with Institute of Conservation Scientists, Preservation and Conservation
Issues in Digital Printing and Photography Conference Organiser

Group Events

Summer 2005
Visit and technical meeting
Details to be confirmed

October 19th, 2005
Student Conference 2005 and AGM
Colour Chemistry Department, University of Leeds
Further information to follow.
Offers of papers to Dr Phil Green green@colourspace.demon.co.uk

January 12th 2006

Topics in Printing, Papermaking and Packaging (provisional title)

Institute of Physics, 76, Portland Place, London

Full day meeting, jointly held with the Retired Members Section

Programme to be confirmed.

April 24th - 25th 2006

3rd International Conference on

Preservation and Conservation Issues in Digital Printing and Photography.

Institute of Physics, 76, Portland Place, London

Second Call for Papers <http://conferences.iop.org/PPP/>

Potential sponsors are invited to contact the organisers.

Other events of potential interest

Eighth International Conference On Web Handling

June 5 - 8, 2005

Oklahoma State University, Stillwater, Oklahoma, USA.

Web handling is the engineering science underlying thin flexible sheet processes such as printing, drying, coating, laminating, slitting and winding. The meeting will provide a forum to exchange ideas, present technological advances, and discuss future directions. It will cover the topics of air support and conveyance; lateral mechanics, dynamics and control; longitudinal dynamics and tension control; measurement techniques; out-of-plane dynamics; sensors and signal processing; slitting and runnability; winding and unwinding; and wrinkling.

Further information is available from Ms. Linda Rogers, Conference Coordinator

IWEB2005, Oklahoma State University, 512 Engineering North, Stillwater, OK

74078-5023, USA. Phone: +1 405 744 9217, Fax: +1 405 744 5369,

E-mail: rogerlm@okstate.edu, Web site: <http://www.engext.okstate.edu/iweb5.pdf>.

Drug Delivery And Diffusion Through Polymers

21 June 2005

Institute Of Physics, London

Organised by the Polymer Physics Group of the Institute of Physics, co-sponsored by the Institute of Materials, Minerals and Mining Applied Polymer Science Committee

<http://conferences.iop.org/DDD/>

Polymer Tribology

23 June 2005

University of Birmingham, UK

Organised by the Tribology Group of the Institute of Physics. Co-sponsored by Polymer Physics Group of the Institute of Physics.

<http://conferences.iop.org/PTG/>

15th Interdisciplinary Surface Science Conference

27 - 30 June 2005

Cardiff University, UK

Organised by the Thin Films and Surfaces Group of the Institute of Physics.

Poster abstracts welcome

<http://www.cardiff.ac.uk/chemy/surfsci/ISSC15/>

MC7: Functional Materials for the 21st Century

5 - 8 July 2005

University of Edinburgh, UK

Organised by the Royal Society of Chemistry. Co-sponsored by the Institute of Materials, Minerals and Mining, the British Liquid Crystal Society, the Institute of Physics, Institution of Electrical Engineers.

Registration closes June 3rd.

<http://www.rsc.org/MC7>

Sensors & their Applications XIII

6 - 8 September 2005

University of Greenwich at Medway, Chatham Maritime, Kent, UK

Organised by the Instrument Science & Technology Group of the Institute of Physics in conjunction with the IEE and IOM³.

<http://conferences.iop.org/sensors/>

Advances in Paper Science and Technology – FRS13

11-16 September 2005

Robinson College, University of Cambridge, UK

13th Fundamental Research Symposium in the Oxford and Cambridge Series.

Organised by PITA on behalf of the Paul and Paper Fundamental Research Society in conjunction with TAPPI and PAPTAC.

Programme and registration details on

www.ppfrs.org.uk

Physical Aspects of Polymer Science

12 - 14 September 2005

University of Leeds, UK

22nd Biennial Meeting of the Polymer Physics Group of the Institute of Physics

Deadline for abstract submission 31st May

<http://groups.iop.org/PO/biennialinformation.html>

Novel Applications of Surface Modifications

18 - 21 Sept 2005

Chester College, Chester, UK

Organised by the Applied Physics and Technology Division of the Institute of Physics. Sponsored by the Thin Films and Surfaces Group, the British Vacuum Council, and co-sponsored by the Institute of Materials, Minerals and Mining.

Poster abstracts welcome

<http://conferences.iop.org/APTD/>

Materials Congress 2006

April 5 – 7 2006

Carlton House Terrace, London

Organised by the Institute of Materials, Minerals and Mining (IOM³)

Call for papers closes June 30th

<http://www.iom3.org/congress/>

Non Conference Events

PD2005

A two-day development conference

24-25 October 2005 in London

Meet and develop with 100 physicists and engineers from every sector imaginable.

For information and to register go to <http://careers.iop.org/pd2005>

This Conference **IS NOT** about technical aspects of your work. You will not hear anything about latest techniques or tools available (unless another participant mentions this to you over the excellent dinner on Monday night).

This conference **IS** about exploring your own skills and talents and enhancing your ability to work in different situations within your organisation.

In store for 2005

- Setting and achieving personal goals
- Communication skills - How to handle yourself, your manager and your colleagues
- Time management
- Avoiding Stress
- Team Building
- Delegation
- Chartered Status - what it is and how you get it
- Excellent networking opportunities
- Plus more...

Conference Fees will be just £210 for members with a 50% discount for students. The conference dinner is included but delegates are asked to organise their own accommodation. A list is available. Fees include VAT.

Non-members are very welcome. Fees for non-members are higher (£250) but you can qualify for the Member rate if you submit a membership application at the same time as registering.

BURSARY

The printing packaging and papermaking (3Ps) group of the Institute of Physics is set to run its Annual Bursary scheme again. The aim of the bursary is to assist in supporting a UK-based student engaged in postgraduate research in any one or more of the 3Ps, in particular where the application of physics can be demonstrated. The value of this award is a one-off payment of £500. In order to apply, students are asked to send a brief academic profile of themselves, an abstract describing the scope of their proposed or current work (no more than 200 words long) and the name of an academic referee, preferably their project supervisor, by e-mail to Nigel Sherman nigel@woolpitshermans.plus.com. The closing date for applications is 11th July 2005.

Call for submission

to the

Institute *of* **Physics**

Printing, Papermaking and Packaging Prize 2005

The award comprises a certificate and a prize of £300.

The Institute of Physics Printing, Papermaking and Packaging Group will present an annual prize to an individual or organisation that has contributed a significant theoretical or practical application of physics in the areas of printing, papermaking or packaging.

The winner will be invited to present their work and receive their prize at the Group AGM, (late 2005 or early 2006).

Applications for the prize should be submitted in the form of a brief summary of the work in English, by August 2005, to: Andrew Hanson, NPL, Hampton Road, Teddington Middlesex, TW11 0LW. Enquiries regarding the award may be sent to this address or by E-mail to andrew.hanson@npl.co.uk