

# Schools Affiliate Scheme

# Newsletter

Issue 8: Spring Term 2001.

## Polymer projects?

In 1993 The Institute of Materials was created from the merger of The Institute of Metals, The Institute of Ceramics and The Plastics and Rubber Institute. Although in its present form it could be considered rather new, the individual parts that have come together to make up the present Institute of Materials, date back over 100 years.

Furthermore, the individual sections that went into that merger have not completely disappeared. There is still a very active group of members with a special interest in polymers, working to help promote that area of industry within the greater aim of the institute to promote all areas of Materials Science and Engineering. The Polymer and Rubber Institute, (PRI) handbook is a pocket sized edition full of contact details of local societies, companies and useful information about the polymer industry.

Whilst not specifically designed for use by teachers, you may find it useful when looking for local contacts to help with project work and it is available on request. Why not ask for a copy when you send us your faxback sheet about *Materials World*. See page 7.

## Option to invoice

A number of teachers have mentioned that it is much easier to pay for their annual membership subscription if we invoice the school rather than you having to raise a cheque beforehand. Accordingly we have incorporated this option into the application and renewal forms. Whilst we appreciate it when you take the time to complete these forms, if necessary you can renew over the phone and we will process your application immediately. Invoicing your school direct.

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**MATERIALS**

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# Careers Page

Have you tried The Institute of Materials careers website yet? It is packed full of information for you and your pupils such as examples of real career paths taken by scientists and engineers in industry, details of the qualifications needed to enter a specific field and up to date details of what careers in different sectors really means. (i.e. pay and prospects!)

The specific areas of industry are divided into six main sectors for easy navigation:

Transport

Sport

Areospace

Communications

Medicine

Energy

In "Meet the People" your pupils will soon see that Materials does not just cover the obvious careers and hopefully their interest will be sparked by what they read. Below are two examples to whet your appetite.

## Neil Gregory



### **Clinical Scientist Access to Communication and Technology**

**What I do:** I work in an NHS department concerned with assessment and provision of environmental controls and communication aids for disabled people in the West Midlands area. Specifically developing novel software for use as assessment tools.

**Who I work with:** A multi-disciplinary team of Clinical Scientists, Speech and Language Theapists and Medical Technical Officers.

**Why I enjoy my job:** Satisfaction of helping people very much in need of our

help.

**What I studied:** Biomedical Materials Science and Engineering at QMW – BEng Bio-engineering at Strathclyde, M.Sc.

## Andrew Miller



### **Industry Specialist, Epoxy Products and Intermediates**

#### **Dow Deutschland Inc.**

**What I do:** Market Development and Management of Structural Composites Projects for Europe using Dows Vinyl Ester and Epoxy range. Project commercial value ranges from 100,000 USD to over 5M USD. The job is based at our Vinyl Ester Production facilities in Rheinmuenster. This is located in South Germany close to the Alsace region of France. I am also responsible for Customer Interface Initiative helping our business use tools such as e-commerce to complement our service to our customers.

**My favourite projects:** They are all good! The largest is our interest in Wind Energy – the growth potential is enormous in this fast moving market. E-commerce is also an extremely fascinating subject.

**Who I work with:** Customers! Without them we would not survive. Internally I deal with everyone in our business, Tech Support, Field Sales, Production, Commercial Management and Order Fulfillment, it can be extremely demanding.

**Why I enjoy my job:** It's challenging, varied, interesting and fun. I have travelled all over Europe (I worked in sales before taking this position) and enjoyed several unique experiences and met many different types of people. I now live in Strasbourg, which is a beautiful city.

**What I studied:** MEng Mechanical Engineering Europe at Newcastle University. I first got involved in composites during my placement in Spain and then moved on to work back at the University as a Research Assistant in composites. I completed my PhD in composites (which I studied part-time) in January last year.

## Scholarships for Sixth Form Students 2001

Since the last issue of the SAS newsletter launching the new Armourers & Brasiers' scholarship scheme CORUS have matched funding and I am pleased to announce that the number of scholarships has increased from 10 to 20.

Awards of £250 plus £50 of materials related books will be made to students in their final year at school or sixth form college and if a recipient goes on to study a materials related course at an approved university the award will continue at a level of £250 per year under the banner of the Armourers and Brasiers Scholarship. The approved universities are, at present, Birmingham, Imperial, Leeds, Liverpool, Loughborough, Manchester, Oxford, Queen Mary & Westfield, Sheffield and Swansea.

In order to apply for an Armourers & Brasiers Materials Scholarship students must be studying post 16 courses suitable for continuation on to a materials related degree programme and must also be considering reading the subject at university. Students should apply for a scholarship at the end of Year 12, the closing date for applications is 12 September 2001, and the recipients will receive their awards at a ceremony at Armourers Hall in December. Students should contact Diane Talbot for an application pack.

You should have now received a flyer about the scheme, however, if you would like to know more please contact: Diane Talbot, Armourers & Brasiers Scholarships 2001, School of Metallurgy and Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT. Telephone 0121 414 5188, fax 0121 414 5232 or e-mail D.Talbot.1@bham.ac.uk

## Materials in the Curriculum

The Chemical Industry Education Centre, CIEC, is a joint partnership between the Chemical Industries Association and the University of York. It aims to improve mutual understanding between schools and the chemical and allied industry. One of the means to do this is to design and publish resources for teaching and learning which support science and technology curricula. The resources place an emphasis on the applications of science and technology in everyday life and the contribution made by industry to society.

The complete range of resources includes those for industrialists and teachers involved with industry-education links, reference texts and those which are self contained teaching packs.

The self contained teaching packs provide something for students of all ages and ability; from primary pupils, to those studying for GNVQ Advanced Science or A-level Chemistry. The full catalogue is available from the Centre.

Of the 70+ resources, 19 are specifically about materials found in the curriculum, for example:

*Coastline protections* (11-14 years, funded by BP) - investigates concrete for an off-shore barrier used to prevent erosion.

*Aluminium, cradle to grave* (14-16 years, funded by Norsk Hydro) - students analyse the environmental impact of using aluminium and gain knowledge of a procedure to compare the metal with alternative materials.

*Recycling Cities* (14-16 years, funded by Hydro Polymers) - covers uses and recycling of polymers. Recycling and degradation are related to manufacturing and economics.

*Product Design: Case Studies for 14 - 16 year olds* (titles include Polyurethane in Sports Shoes, Sleeping Bags, Pop Bottles) include activities which concentrate on the design of products and the properties of the materials used to make them

*Dental Dilemmas* for students on GNVQ Intermediate and Advanced science courses covers materials used in dentistry

*Understanding Plastics for post-16 students* - covers the chemistry and technology behind familiar plastics products.

**Contact - Miranda Stephenson, Manager, Chemical Industry Education Centre, University of York, Heslington, York YO1 5DD. Tel: 01904 432523 Fax: 01904 434460 email: ciec@york.ac.uk**

## The Open Day Season is Back

The Open Day season is back with the University of Leeds, Department of Materials, offering a range of interactive activities on the general Leeds University Open Days of June 29th and September 11th. Just drop in on the day or contact Dr. Tony Bromley for further details or to pre-arrange a specific tailored programme. The Department of Materials is one of the four Departments that constitute the School of



process Environmental and Materials Engineering (SPEME, [www.leeds.ac.uk/speme](http://www.leeds.ac.uk/speme)). Funding is available to cover the hire of a coach to and from a School to SPEME for a limited number of Schools, for either of the Open Days, on a first come first served basis. Schools groups should consist of lower sixth form students planning to take at least one science 'A' level. A two hour activity session will be arranged within SPEME for a school, with the rest of the time being free for schools to explore the rest of the University Open Day.

Within the Materials Department come and see a range of demonstrations and displays from artificial human arteries, see figure, to the thinnest speakers in the world (probably!)

Contact details:- Dr. Tony Bromley, [a.p.bromley@leeds.ac.uk](mailto:a.p.bromley@leeds.ac.uk), tel:0113 233 2362.

### **An Artificial Human Artery -**

Made from knitted polyester.

The same as the stuff in your jumper!

## Exciting opportunities for teachers and students at the University of Birmingham

SAS members will shortly be receiving information about exciting forthcoming events in the School of Metallurgy and Materials at the University of Birmingham.

Our highly successful **Sixth Form Course – What is Materials Science?** will be taking place again this year, between the 2<sup>nd</sup> and 5<sup>th</sup> of July. The course is open to all students in the lower sixth (Year 12) that are interested in finding out more about Materials Science and Engineering and is a careful blend of lectures, laboratory classes, team building activities and social events. The delegates stay in the Halls of Residence, giving them a great insight into student life. The best part is that the course is **FREE!!** All meals, entertainment and accommodation are provided and the only expense to the students is finding their way to and from the School. There are only 30 places available, so we do not normally take more than 2 students from any one school.

Next, two opportunities for you the teachers to learn more about materials! Following the success of the first course last year, Rolls-Royce and the Armourers & Brasiers' are again supporting 2 day **Materials Master Classes for teachers**. The courses will consist of a 2-day residential at the School of Metallurgy and Materials at the University of Birmingham, getting some hands on experience of materials, followed by a works visit to Rolls-Royce in Derby. In June we will be running a course for KS4 teachers and in September we will be holding another course for post-16 teachers. The content of the courses concentrates on the materials aspects of the National Curriculum and the new AS and A2 syllabuses, respectively, giving ideas for experiments and demonstrations along with useful information.

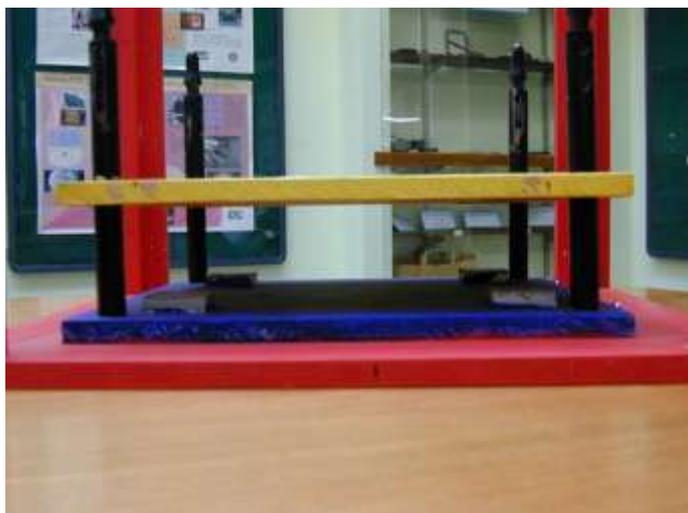
## Fun with Magnets: experiments and Ideas.

Magnets and Magnetism appears in various places in the National Curricula and Post 16 syllabi, and can be a fun subject to study, allowing students to carry out a range of investigations and projects. In this booklet there are a few ideas on ways in which magnets and magnetism can be approached. Some you may have come across previously but some will be few ideas that can be carried out thanks to the provision of two Nb-Fe-B (neodymium-iron-boron) magnets with the pack. This resource is free to all Schools Affiliate Scheme members when they renew during 2001.

The booklet has been produced in conjunction with The University of Birmingham and the Ironbridge Gorge Museum Trust (<http://www.ironbridge.org.uk>) as part of an Engineering and Physical Sciences Research council (EPSRC) funded project for Public Partnerships in Science. It is heavily interspersed with diagrams, data and suggested experiments and, starting from basic principles, examines the nature of magnetism, the earth's own magnetic field, and applications for magnets. Additionally there is a section on current research in this field, a summary of where magnetism appears on the English National Curricula and sources of further information and magnet supplies. A number of common questions relating to magnetism such as; "Why are transformer cores laminated" and "Is magnetism used in nature?" are dealt with at the end of the booklet.

*Fun with Magnets: experiments and Ideas* is a good overview of the subject, with plenty of information and examples without getting unnecessarily heavy. It should provide a useful tool to teachers at a range of teaching levels, although those covering key-stages 3 / 4 or equivalent will probably find it of most use.

## Students at Birmingham walk on air.



Visitors to the School of Metallurgy and Materials at the University of Birmingham can now stand on air thanks to the amazing properties of super-magnets.

The levitating platform was developed as part of a project sponsored by a Partnerships for Public Awareness award from EPSRC (Engineering and Physical Sciences Research Council) to create prototype exhibits for a new attraction in Ironbridge. The platform floats on 8 neodymium-iron-boron magnets, 4 fixed to the base and 4 located on the underside of the platform (see left) and operates on the simple principle that like poles repel each other. The reason that it is able to support the weight of an adult is that the magnetic field associated with these magnets is very strong (see below). A frictionless bearing has also been produced as part of the same project, along with other examples of the use of

magnets. The platform has been used to demonstrate magnetic levitation to groups of school students visiting the School of Metallurgy and Materials and has been extremely well received.

The latest Schools Affiliate Scheme resource, "Fun with Magnets – Experiments and Ideas", by Dr Claire Davis, was also written in conjunction with this project and gives information and ideas on magnetism and the use of magnets. The pack is supplied with examples of magnets which can be used for demonstrations and experiments in the classroom.

If you would like to see the full version of the levitating platform the new "Coalbrookdale Technology Centre" will be opening in mid 2002. If you would like to find out more about this new, exciting, interactive attraction why not have a look at their web-site: [www.ironbridge.org.uk](http://www.ironbridge.org.uk)



# Carbon Fibre Reinforced Plastics? Turn left at steel, straight past balsa wood and you cant miss them

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## Materials charts - a new way of teaching about materials.

Phil Withers, Manchester Materials Science Centre & Hugh Shercliff, Cambridge Engineering Dept

With the plethora of fact sheets and property tables available on 1000s of materials it can be difficult for a student to recognise the special qualities of any material within the materials spectrum, or to identify the best material for a given application. Furthermore, tables of data focus on deductive as against intuitive learners. While a mathematical understanding of materials is important, it is sometimes easier to obtain a 'feel' for a new material by comparing it with others that are well-known. The replies from a set of Cambridge materials undergraduates demonstrate the point. When asked to determine the Young's modulus of window glass answers varied by 21 orders of magnitude! They could define Young's modulus but lacked experience of real materials.

Material selection charts, which were devised by Prof. Mike Ashby at Cambridge University, provide a different approach to learning about material properties and selection. Imagine selecting materials for a 13A plug. Clearly electrical conductivity is an important parameter and should be high for some components (pins, fuse clip, etc) and low for others (plug body, fuse case, etc). Material cost is also an important property. By plotting materials on a chart with raw material cost as the x-axis and conductivity as the y-axis, it becomes a simple matter to locate cheap conductors (lower left) and cheap insulators (upper left) (Fig 1). It is also clear that materials cluster according to their class, e.g. metals at the bottom, polymers and ceramics near the top. This illustrates in a graphic way important physical principles about differences between covalent and metallic bonding.

*Figure 1: A chart of electrical conductivity vs cost*

*Figure 2: A chart of stiffness versus density.*

Another good example is provided by a stiffness - density chart. This chart is useful for selecting lightweight materials for applications such as sports goods and transport. Again basic physics/chemistry principles can be communicated, for example the fact that polymers are much less stiff than diamond despite being based on a C-C backbone because the molecules are held together by weak Van der Waals forces. Properties of natural materials can be related to structure and function. Trees need to be light and self-supporting - look at how balsa wood has excellent stiffness to weight ratio, because it combines a cellular structure with the excellent strength of cellulose. Wood is still used for light aircraft, not just for model planes.

From an early age children can start to test materials and to compare them by building their own charts. For example by bending samples in three point bend and weighing them to produce a flexural rigidity (stiffness) - weight chart. Over small ranges linear axes will do - but clearly logs are needed for the big picture. Inventing and trying material tests is an excellent way to gain a 'feel' for the relevant standings of different materials. The maps present a landscape for learning - locate the position of a new material and immediately comparisons can be made. If you know it's South of Manchester and East of Stockport, you do not need to visit Marple to appreciate something about its location. In the same way students can branch out from materials they experience in every day life, for example steels, to appreciate the merits of magnesium alloys or carbon fibre reinforced polymers (for example, as advanced materials for bicycle frames). Selection charts retain scientific rigour, but remove the clutter of data tables that inhibits creative thinking and questioning. Why don't ceramics make good bicycles? Why, given its cost, is silicon used so widely in electronics?

Charts can help teach many aspects of materials physics/chemistry, and materials in design. If you would like to consider using them at any level, resources are available from the Technology Enhancement Programme (TEP) - a CD-ROM and supporting booklets ([http://www.tep.org.uk/cdroms\\_2000.htm](http://www.tep.org.uk/cdroms_2000.htm)), or through our EPSRC funded web site (<http://www-materials.eng.cam.ac.uk/mpsite>). Some of the resources are also available via OCR's Website (under A level Design & Technology), and on the IoP A Level *Advancing Physics* CD-ROM.

# Materials World

The Institute of Materials' Schools Affiliate Scheme is designed to be of help to teachers and so we really value your help and advise in developing the scheme. As you will have noticed when you receive your renewal form, we are interested in your views on different aspects of the scheme and the help that we provide. Although there are some areas that some find of more use than others, one subject on which we are getting a lot of similar comment is the institute journal *Materials World*. A lot of teachers say that: "it is too advanced" "we do not have enough time to read it" "it is too specific and therefore not of great relevance to teaching". We do not wish to bombard you with information that you do not find useful and we are therefore considering discontinuing issue of *Materials World* to teachers. However, maybe you feel differently. We would like to hear your views. Do you want to keep on receiving it? Whatever your views please let us know using the Fax back form below.

**If there is general agreement that *Materials World* is superfluous then we will discontinue its issue to teachers from the July issue.**

However if you want to keep receiving *Materials World* then depending on numbers it we can arrange that on an individual or general basis. This is in your hands, so drop us a line.

Likewise if there is anything else you would like to tell us then this is a great opportunity to do so. It should not take you long and we do appreciate your feedback to help us to help you.

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## Schools Affiliate Scheme: Information Faxback

Please complete the form below and fax back to Ruth Withey (0114 270 6303)

**School Name** \_\_\_\_\_

**Contact Name:** \_\_\_\_\_

**Phone Number** \_\_\_\_\_

**Fax Number** \_\_\_\_\_

**E-mail Address**  
\_\_\_\_\_

Please delete as appropriate to indicate your requirements:

**I would / would not like to continue to receive *Materials World*.**

**Comments:**  
\_\_\_\_\_  
\_\_\_\_\_

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# Year in Industry Bridges The Gap .

**The Year in Industry** is a national organisation, which places bright, well-motivated students in industry for their gap year before their degree. The pre-screened students are matched with companies on the basis of their chosen degree subjects, usually engineering, science, computing and business studies.

*The students gain valuable experience, which informs their career choice and helps their academic studies and the companies gain a cost-effective resource and early access to potential graduate recruits.*

**The Year in Industry** has been successfully placing students since 1987. Last year nearly 800 talented young people were placed in industry across the UK and the scheme has been awarded The Royal Academy of Engineering Mark of Excellence as part of the Best Programme.

The benefits to students include:

- Practical experience in your future degree and career area.
- A salary which allows you to save towards the cost of university
- A wide range of job opportunities both near to home and across the country
- A break from formal study and a year to develop your personal skills.
- An extra qualification in business and management awareness
- Support and training during your year to ensure everything runs smoothly
- Greater focus and practical background for your chosen subject
- Other opportunities such as Raleigh International and sponsorship
- The students gain valuable experience, which informs their career choice and helps their academic studies - 25% go on to gain a First Class Honours degree and a further 48% achieve 2(i).

Companies of all sizes support **The Year in Industry** and offer 12 months structured placements, not just for the technical and commercial benefits, but as an early entry into graduate recruitment.

Company loyalty is developed very early as Mike Jenkins, now employed full time at Newby Foundry illustrates. Newby are a market leader in high quality iron castings, employing over 100. So pleased were they with what Mike Jenkins achieved during his Year in Industry that after he had completed his First Class Honours Manufacturing Degree at Wolverhampton University, they invited him back as a full time member of the management team.

Mike spent his Year in Industry at Newby helping the foundry consolidate a site move and installing a computer network. He returned for vacation work and after gaining a First Class degree in Manufacturing Engineering is now permanently employed as Newby's Systems Engineer. He mentors the current Year in Industry student and last year's student who implemented an Energy Management System. He feels that it is "worthwhile to pass on his experience to others"



**The Year in Industry** operates an annual cycle that fits in with the academic year and is matching students with companies requirements now right through to the summer, to start in September 2001. If you would like to know more about the opportunities available from a structured Year in Industry then visit our website [www.yini.org.uk](http://www.yini.org.uk)

The photo above shows Megan Harper, a former Year in Industry student now a 1<sup>st</sup> year undergraduate studying Materials and Mechanical Engineering at The University of Birmingham.

The photo (left) shows L to R John Lewis, last year's YII student, Phil Brooks the current YII student and Mike Jenkins, now Systems Engineer at Newby Foundry