



The Institute of Materials, Minerals and Mining

**Schools
Affiliates
Scheme**

Issue 21

Autumn Term 2005

Welcome back

Hello there and welcome to the first newsletter of the new academic year. I hope you had a relaxing and enjoyable holiday, safe in the knowledge that we have been working hard here in Doncaster.

This term is looking like it's going to be a busy one! On page 4 you can find my diary and details of the new booking procedure we are implementing from September. Last year was the busiest to date in terms of visits and when I look back I can hardly believe the number of miles I have driven to bring materials to the masses! In total I made 92 visits to give 194 presentations to approximately 6,500 people. Many of the schools that I visited were kind enough to complete and return the evaluation forms and as you can see from the results on page 5 my activities seem to be going down well. So if you have not invited me to your school before maybe this will persuade you to book a visit. If you would like to find out more about the activities on offer please get in touch by e-mail (diane.talbot@iom3.org).

Also in this issue you can find the usual careers profile on page 2, details of the remaining November open days on page 7 and an element focus on page 8 inspired by one of the most popular samples in my bag of bits, tungsten.

Also featured in this issue are the Schools Starpack Awards on page 3. In previous years this competition has only been open to those in further and higher education, however, this year a special schools category has been included with 3 design briefs to choose from. This is an ideal opportunity for your talented product design, graphics and resistant materials students to shine.

There is also a special feature about our 60 local societies and a special schools event being run by the London Materials Society at the start of Science Week next year.

As usual if you have any comments please get in touch and do come along and say hello at the D&T show at the NEC in November.

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Career Profile – ROBERT BATTY

Studied MEng Materials Engineering (2.ii)
Studied at University of Birmingham
Current employer Ford Motor Company
Position Senior Materials Engineer

What do you do? I am a metallurgist / materials engineer and my job mainly entails detailed materials investigation of metallic automotive components (approximately 77% of motor vehicle composition). I investigate the material aspects of component tests from dynamometer cells to durability track tests. This requires high acuity during visual examination and the non-destructive testing phase, and a logical and thorough examination technique, to ensure that nothing is overlooked and as little as possible 'evidence' is lost or destroyed during the more destructive analysis stage. The work involves the use of analytical tools such as high magnification light microscopes, electron microscopes and spark emission spectroscopy, and non-destructive techniques such as x-ray analysis and fluorescent crack detection. The work also requires extensive use of mechanical testing facilities, such as tensile testing and fatigue testing apparatus, impact and hardness testing equipment, etc.. The responsibility of my position involves evaluating results, drawing conclusions and making materials and design recommendations on the basis of my observations.

Why do you enjoy your job? Everything I work on is a project of some description, is always varied and never a matter of routine testing. I enjoy all aspects of my work, especially on the rare occasion that it takes me to manufacturing plants in other countries, where I am able to use my knowledge of materials and processing to good effect to benefit the business. I am often involved in multi-disciplinary team of engineers who are working towards finding the root cause of a particular problem. Working on problems of this nature is very rewarding but is not without a certain amount of stress. Working like this can propel you beyond the boundaries of your comfort zone for a while and this helps to stretch one's abilities and develop a more holistic viewpoint on engineering and the business world.

Who do you work with? I work in a metallurgical section of five people, in a department of approximately 25 specialist engineers which include fastener, polymer, textile, chemical and advanced materials engineers. I interface with all levels of personnel throughout the company, from technicians and toolmakers to high level management. I most commonly work with component engineers and some external suppliers. The people-side of my job has always been the most important aspect to me and to my work. In order to evaluate problems and obtain all the relevant information it is usually most beneficial to have face-to-face consultation. Communication with my materials engineering colleagues is an integral part of the failure analysis work I am involved in. It helps to build a stronger team and improves our own individual materials knowledge. I often have to communicate with people from diverse backgrounds because of Ford's global operation. Presenting thoughts, ideas and logical arguments on a technical subject effectively and without ambiguity to such a wide ranging audience is one of the most difficult and rewarding challenges of my work, and something which I look forward to continuing for a long time to come.

D&T with ICT show 2005 and ASE Annual meeting 2006

Just a quick reminder to let you know that we will be exhibiting at the D&T with ICT show at the NEC near Birmingham from 17 to 20 November. Come along and say hello and see the new Institute publication on packaging. And don't forget that we will also be exhibiting at the ASE meeting in Reading from 5 to 7 January. The meeting will feature a series of lectures and workshops relating to materials, minerals, mining and earth sciences that we are organising jointly with the ESTA and ESEU.

Schools Starpack Awards 2005

In an increasingly competitive consumer market there is a growing demand for packaging designers. People who are capable of designing packs which are not only graphically attractive, but which also meet the functional requirements to preserve the contents and can be produced cost effectively with due regard to environmental issues. These challenges lend themselves to an exciting and rewarding career in a cutting edge industry.

This prestigious competition has previously only been open to university undergraduates and college students but for only the second time, this year there is a special category for schools. There are three briefs from which to choose:

Brief A – SUN PROTECTION COMBINATION PACK (Key Stage 4 and AS level)

You are required to design and produce a ‘Sun Protection Pack’ which will appeal to those people that like to spend a lot of time in the sun. The pack will contain up to four sun care products, such as sun cream, lip balm, sunglasses and after sun lotion. In addition, the pack should be designed such that it may be adapted to form a head protector, such as a hat, cap or visor, with either all or part of the outer and/or inner packaging. The main material used for this pack must be carton board but you may include some polythene if some form of visibility is required. You should consider using unusual and innovative shapes and look at handling and display options for the pack. The graphics and design of the pack should reinforce the message of sun protection and you must consider the recycling of the pack and environmental issues. Material can be supplied by ProtCarton who are sponsoring the awards. Please contact info@procartonuk.com

Brief B – NEW POLYTHENE PACK (up to Key Stage 3)

Polythene bags can be found throughout the UK food and non-food retail sectors ranging from bags for garden compost to packaging for frozen peas or bread. Polythene film is lightweight, strong and uses less raw material and energy compared to non-polythene materials. You are required to design a new and unique use for polythene film. This could be a bag, a carrier or perhaps a product. When designing your new use consider a secondary use for after it has fulfilled its original purpose. Could your design be used again, such as supermarket carrier bags being used as bin liners? Your pack should be innovative in its use and product area and must be made from at least 80% polythene. You must demonstrate how the pack should be displayed and consider how the pack may be re-used and recycled. You may use your own branding and graphics if appropriate. Material can be supplied by BPI who are sponsoring the awards. Please contact Mike Baxter at MikeBaxter@bpipoly.com.

Brief C – MATERIALS RESEARCH BRIEF (Key stage 3, 4 and AS level)

You are required to work in a team to research and investigate one of the materials used in our packaging industry for the production of products and packaging (choose from metal, glass, plastic, glass, paper and board). This research should include details of the material’s origins, properties, manufacturing processes, benefits, sustainability, environmental implications and production costs.. From the existing packaging market and product ranges choose a new product/package for your chosen material, one that does not use this materials in any form at present. The Institute of Materials, Minerals and Mining Materials Information Service is available to provide information. However, we ask that questions are collated by the teacher (to avoid duplication of enquires by the same school) and e-mailed to anita.horton@iom3.org.

OPEN DAY

You are invited to attend the **Schools Starpack Open Day** on **Wednesday 02 November** where you can find out more about each of the briefs and meet the sponsoring companies. The open day will take place at our Stamford Office, starting at 1100 and including lunch. If you would like to find out more information or book a place on the open day please contact Rachel Brooks on 01780 759211 or e-mail Rachel.brooks@iom3.org. Further information can be found at www.starpack.uk.com.

DIANE'S DIARY

Bookings for the Autumn Term have been coming in thick and fast and I'm pretty much booked up now. Here's where I'm planning to go already...

- 8-9/09 Aberdeen UCAS Convention
- 13/09 Oundle School, near Peterborough
- 15/09 King Edward VI School, Southampton
- 15/09 Wellington College, Crowthorne
- 16/09 Peter Symonds College, Winchester
- 20/09 Alsager School, near Stoke on Trent
- 21/09 King Edward VI Handsworth School, Birmingham
- 22/09 Rolls-Royce Masterclass, University of Birmingham
- 30/09 *Stowe School, Northamptonshire*
- 05/10 Riddlesdown High School, Croydon
- 06/10 Ripon College, North Yorkshire
- 07/10 *Ampleforth College, near York*
- 10/10 Lutterworth Grammar School, Lutterworth
- 12/10 Aquinas College, Stockport
- 13/10 Cleeve School, Cheltenham
- 14/10 Colyton Grammar School, Devon
- 17/10 Marlborough College, Wiltshire
- 02/11 Schools Starpack Launch, Stamford
- 05/11 Scottish TTA Conference, Dundee
- 09/11 Framwellgate High School, Durham
- 10/11 Salendine Nook School, Huddersfield
- 11/11 Woodhouse College, Barnet
- 17-19/11 D&T with ICT Show, NEC Birmingham
- 21/11 St Clement Dane's School, Chorleywood
- 23/11 La Sainte Union Convent School, London
- 24/11 Lady Lumley's School, Pickering
- 25/11 Brighton Sixth Form Chemistry Conference
- 29/11 Hurstpierpoint College, near Brighton
- 30/11 Our Lady Queen of Peace School, Skelmersdale
- 02/12 Ditchum Park, Petersfield
- 05/12 *Manchester Polymer Group Young People's Lecture*
- 07/12 King Edward VII School, Sheffield
- 08/12 Moulsham High School, Chelmsford
- 09/12 *Graham School, Scarborough*
- 14/12 Robert Pattinson School, Lincoln
- 15/12 Queen Mary's College, Basingstoke
- 16/12 Robert Pattinson School, Lincoln

Dates remaining for this term and next are as follows:

- Sept: 28, 29
- Oct: 27, 28
- Dec: 19, 20
- Jan: 11, 12, 18, 19, 20, 25, 26, 27
- Feb: 09, 10, 15, 16, 17, 23, 24
- Mar: 02, 03, 08, 09, 13, 14, 15, 22, 23, 24, 29, 31
- Apr: 05, 06, 07

As usual, send me an e-mail if you would like to book a visit.

New visit booking procedure

Over the past four years the demand for my time has increased dramatically and if you have tried to book a visit you will know that my diary fills up almost a term in advance. As a consequence of this and the fact that I am not in the office very often during term time and your booking may be taken by one of my colleagues, we are introducing a new booking procedure from September.

As before, the easiest way to book a visit is by either e-mailing me or telephoning the office. In the latter case if I am out of the office you will speak to Anita Horton. Once we have managed to pin down a date and decide what you would like me to come and do in school you will be sent a **Booking Confirmation Form**. This form contains all the details you have supplied at the time of booking and may need you to complete a few final details. It is imperative that you sign and return this booking form to us as soon as you can. If we have not received your completed form **one month** prior to my proposed visit it will be cancelled so that the date can be offered to other schools.

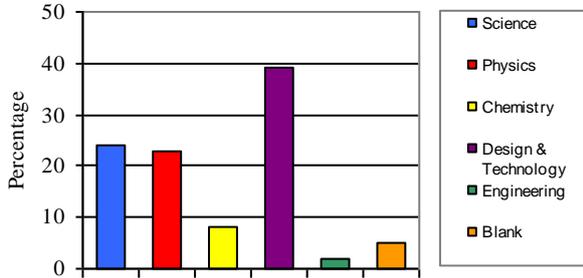
I appreciate that it can often take time to make arrangements if timetables are not yet known or you need to arrange for students to be taken out of other classes. But hopefully this new procedure will make things easier and clearer for all concerned. If you have any questions regarding this procedure, please get in touch on **01302 380902** or e-mail me at **diane.talbot@iom3.org**.

Confirmation forms will be going out to those of you who have already made a booking for the 2005-2006 year at the start of term. Obviously it will not be possible for the September and October schools to return the forms one month before my visit, but your swiftest response would be much appreciated.

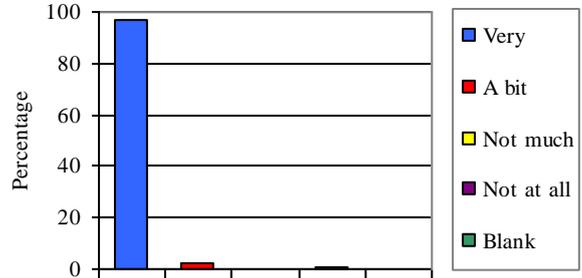
Feedback from school visits

Since the start of last September we have been sending out evaluation forms after I have visited a school to try and determine whether the presentations I give are relevant and useful. Below is a summary of the results from the forms that were returned to us, the majority of the activities were talks, a small number were a practical activity. If you have not had a visit yet, perhaps the results below may persuade you that a visit is worthwhile! If you would like details of the activities we can offer please get in touch.

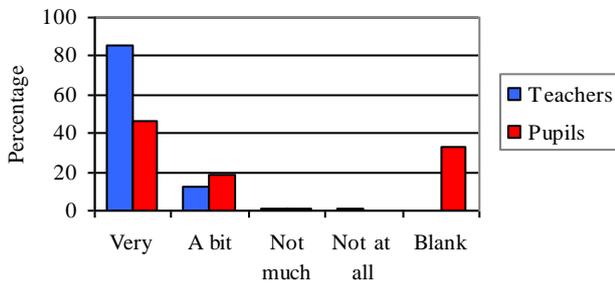
Subject activity used to support



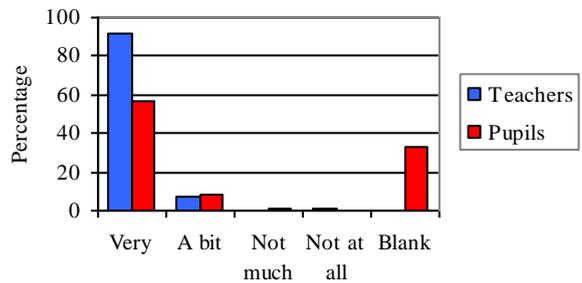
Was your speaker enthusiastic?



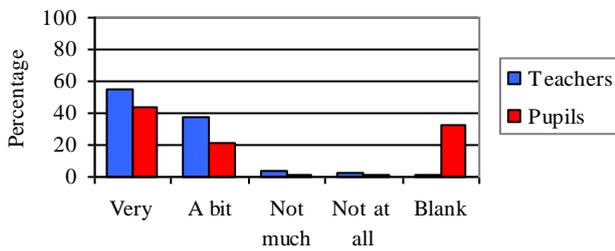
Was the activity relevant?



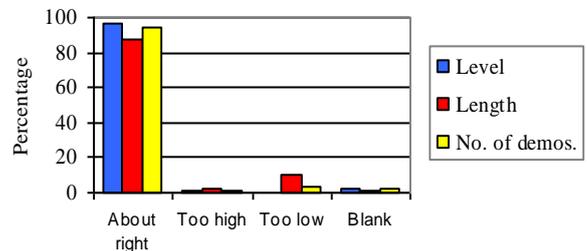
Was the activity interesting?



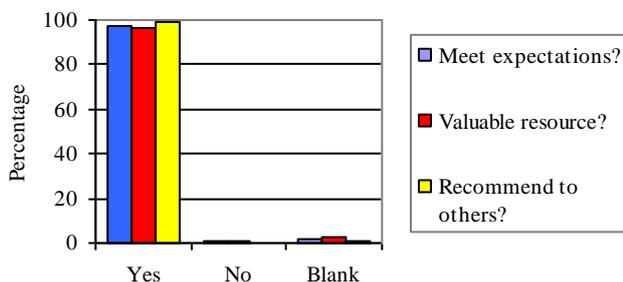
Did the activity assist with your teaching and enhance your pupils understanding?



What about the level, length and number of demonstrations in the activity?



Overall impression



London Materials Society Schools Day 2006

The London Materials Society is organising its 5th Annual Schools Event on **Thursday 09 of March 2006**, to coincide with Science Week which starts on the 10th. The event is aimed at school pupils from age 14 upwards and is designed to allow teachers and pupils to cover aspects of the science and technology curricula and interact with materials experts from London-based Universities.

At the first event in 2002 pupils began their day at the Science Museum, where Dr Sue Mossman and her team guided them through the Challenge of Materials Exhibit. The group of more than 70 pupils and their teachers then moved onto the Royal Society where they were introduced to members of the London



Materials departments. The departments gave presentations on ceramics, polymers and biomedical applications for materials, and students were able to explore possibilities at the 'Materials in Action' Exhibit. Since then a similar programme has been put together each year where pupils spend the morning at the Science Museum and the afternoon at Imperial College London.



The 2006 event will be hosted at the prestigious **Wallace Collection**, just off Oxford Street in the West End of London.. Among its many treasures it houses one of the finest collections of French eighteenth century pictures, porcelain and furniture, seventeenth-century paintings and a superb armoury. The Wallace Collection offers pupils an informative but pleasurable experience and is an outstanding resource for teachers. The rich variety of the displays enable a wide range of subjects to be studied. The building has the most sumptuous interiors of any museum in London, offering pupils an impressive experience of what the house of a wealthy nineteenth-century art collector would have been like, and the Armoury comprises the most important collection of Arms and Armour outside the Royal Armouries.

The day will commence at 10 am with a tour of the collection and will continue with presentations on ceramic, metallic and polymeric materials. One of the high-lights of the day will be a 'Hands-on Armour session' where pupils will discover how the different ranks of the Tudor army protected themselves in battle and they will investigate the purpose, materials, production and style of armour from this period. Pupils and teachers will also have an opportunity to meet and talk to members of the Materials Departments of various London based universities. It is hoped that the day will finish by 3 pm.

The days activities will mainly support the National Curriculum in Science (Grouping and classifying materials; looking at ways in which artists have exploited and changed characteristics of materials such as metal and glass) and Design & Technology (many examples of different materials and their uses, mechanisms and structures). The tour of the collection will also support other subjects such as art, history and English.

If you would like your school to participate in the London Materials Society 5th Annual Schools Event please contact **Dr. Priya Pavan** on **07765 250469** or e-mail PPavan@billericay.essex.sch.uk.

Schools Day at Congress 2006

Congress 2006 will be taking place next year from 05 to 07 April at Carlton House Terrace in London. This is the flagship conference of the Institute and covers all aspects of the materials cycle from extraction to recycling. Following on from the success of the Schools event that we ran at Congress 2004 we are planning to host a special event for school teachers again in 2006. As yet the date hasn't been finalised but the day will feature the chance to attend technical sessions on a wide variety of topics, a visit to the Education Centre Tower of London where there will be a series of education-related presentations and finally a reception at our Head Office with the chance to meet representatives from the Worshipful Companies. If you would like to find out more about the technical symposia at the Congress details can be found on our web-site, www.iom3.org/congress/index.htm and watch this space for further details of the schools event.

Schools and Local Societies

Are you making the most of your SAS membership? Are you making use of the engineers in your local community?

Don't forget that as Schools Affiliate Scheme members you are full members of the Institute. This gives you an open invitation to attend the meetings of your nearest local society. So who are these local societies I hear you cry? Well there are 60 societies in total, 12 in the South East region, 9 in the South West, 12 in the Midlands, 11 in the North East, 9 in the North West and 7 in Scotland and Ireland. Each group has a Committee or Council made up from scientists and engineers from local companies and universities and they organise a programme of events every year starting in September and running through to June. These could be technical lectures, company visits or social events. Indeed many societies are trying to work more with schools and perhaps incorporate a schools event (such as that organised by the London Materials Society on page 6) in to their programme.

Going along to these meetings, which usually take place once a month in the early evening, is your ideal chance to meet local people working in materials, minerals and mining. You might find that one of the companies may be able to supply you with off-cuts of material or offer work experience for your students. It is a chance to develop your knowledge of materials too. Some of the lectures may even be suitable for your students to attend. (I remember going to a fascinating lecture about the science of chocolate organised by my local society when I was in Birmingham).

A calendar of all the events taking place in each region is available on our main web-site at www.iom3.org/regions. Here you can also find contact details of the secretaries, a useful contact for maybe finding out about the depth or content of a talk, or sourcing local materials information (e.g. suppliers).

In November Peter Davies and I are attending the next Local Society Forum, where representatives from the groups get together to discuss regional matters. We will be giving a presentation about the work of the Education Team and Schools Affiliate Scheme. If you have any ideas as to how you think local industry may be able to help you this is an ideal opportunity for us to put these to the people on the ground. Please e-mail your suggestions to diane.talbot@iom3.org.

November Open Day Programme

Thank you to all of you that have already booked places on to this years events. Confirmation of booking letters should be with you at the start of term. I have contacted the relevant university departments with your details but it wouldn't hurt if you got in touch to confirm the finer details.

There are still a number of dates available (see below) so to book a place complete and return the booking form (sent out before summer) as soon as possible, the closing date for bookings is Friday 14 October.

Birmingham	9, 16, 23, 30	Newcastle	9
Imperial	2, 9, 16, 23, 30	Nottingham	16
Leeds	16, 23, 30	Oxford	4, 10, 16, 22
Liverpool	9, 16, 23	Queen Mary, UL	9, 16, 23, 30
London Metropolitan	2	Sheffield	2, 9, 16, 23
Loughborough	10	Swansea	2, 9, 16, 23, 30

TUNGSTEN

One of the samples in the bag of tricks I take round schools never ceases to amaze students because of its weight. So I thought it would be nice to find out a bit more about tungsten...



- Tungsten has the highest melting point of all the metals at a temperature of 3422°C. It remains liquid over a large temperature range and boils at 5555°C. At temperatures above 1650°C it has the highest tensile strength of the metals too.
- Tungsten is very dense in comparison to other materials. Its density is 19250kg/m³ compared to 7874kg/m³ for iron and 2267kg/m³ for carbon.
- The name tungsten, which originates from the Swedish words *tung* and *sten* meaning heavy stone, was first applied to the mineral that we now know as scheelite in 1758. In 1779 Peter Woulfe looked at the mineral wolframite and decided that it must contain a new substance. In 1781 Sheele and Berman discovered tungstic acid and suggested that this may be reduced to yield a new metal. In 1783 Juan Jose and Fausto de Elhuyar put these two ideas together and isolated tungsten by reducing tungstic acid in wolframite using charcoal.
- The chemical symbol for tungsten, W, comes from wolfram. Medieval German tin smelters discovered that they obtained a lower yield when their tin ore also contained tungsten and said that the tungsten devoured the tin 'like a wolf', hence wolfram. The tin ore cassenite is frequently found with wolframite.
- The main ores of tungsten are wolframite (iron, manganese tungstate, FeWO₄/MnWO₄) and scheelite (calcium tungstate, CaWO₄). It is also found in huebnerite and ferberite.
- It is thought that 75% of the world's tungsten deposits are in China, however, other important sources are found in the USA, South Korea, Bolivia, Portugal and Russia.
- Today tungsten is commercially produced by reducing its oxide with hydrogen or carbon.
- There are five naturally occurring stable isotopes of tungsten: ¹⁸⁰W (0.12%), ¹⁸²W (26.50%), ¹⁸³W (14.31%), ¹⁸⁴W (30.64%) and ¹⁸⁶W (28.43%). A further 21 unstable isotopes are recognised.
- Tungsten cannot be melted and cast like many metals owing to its high melting point. The starting point for all products is therefore very fine pure tungsten powder. The powder is pressed into a bar which is sintered prior to swaging and drawing. Pure tungsten is ductile, however impurities make the material become brittle.
- The co-efficient of thermal expansion of tungsten is about the same as that of borosilicate glass which means it can be used for glass to metal seals.
- The development of tungsten for lamp filaments began in 1904. It is also used as a filament in electron and television tubes and for metal evaporation work.
- Its high melting point, hardness and corrosion resistance mean it can be used for car distributor electrical contact points, furnace windings and heating elements and high temperature uses in missiles and space applications.
- In 1857 Oxland took out a patent which described the manufacture of iron-tungsten alloys. These form the basis of modern high speed steels which are extensively used in machining.



- Tungsten carbide is very hard and is used as a cutting tool in metal-working, mining and the petroleum industries. The tool pictured is used for drilling cores during exploration.
- Calcium and magnesium tungstates are used in lighting and tungsten salts are used in the chemical and tanning industries.
- Tungsten disulphide is used as a dry lubricant at temperatures up to 500°C.
- Tungsten bronzes are used in paints.

This newsletter is written and edited by Dr Diane Talbot, Education Co-ordinator. If you have any comments or articles please contact Diane on 01302 380913, e-mail Diane.Talbot@iom3.org or write to her at the Doncaster address on the front cover