



The Institute of Materials, Minerals and Mining

Schools
Affiliate
Scheme

Issue 17

Summer Term 2004

Here comes Summer...

Blimey, where do the months go?! Another academic year is drawing to a close and amazingly it will be the end of my third year in this position. As a consequence we felt it would be a good time to sit back and reflect on the service we have been providing you and we really need your feedback. Coming out to you very shortly is a detailed feedback form and a pre-paid envelope. We would be really grateful if you would fill in this form and return it to us. As I keep saying in each newsletter, this is your scheme and we need you to tell us what you think! Do you think the newsletters are a good read but not really relevant? Have you been able to use the resources in your teaching and do you share them with your opposite department? Have you had a school visit, what did you think, and if not, why not? Do you think the scheme offers good value for money? These are all things we would like to know. You will also read later on that we are starting to try and evaluate the presentations in schools and measure their usefulness. Your cooperation with this would be very much appreciated.

On to other exciting things...

Thank you to all who attended the Schools Day at Congress. We felt the day went very well and your feedback said the same. We would like to organise future events for member schools, particularly where we can involve careers advisors. Any thoughts on this would also be very welcome.

World Materials Day 2004 will be on Thursday 04 November and once again we will be running a competition for schools with excellent prizes (£250 for the schools and £15 for the winning team members). For more details read on.

The Autumn Open Day programme will be running again this November so book your places soon. We hope to make this years event bigger and better than ever!

Finally, as it is nearly the end of the year, I would like to say thank you to all those schools that I have visited this year. I have been made to feel very welcome everywhere I've been, and on the whole the students have been great! Don't forget to get in soon with your bookings for next year! I hope you all have a great summer break.

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Armourers and Brasiers CORUS Scholarships 2004

Once again this year the Worshipful Company of Armourers and Brasiers' and CORUS are offering scholarships for students in the lower sixth (year 12) that are interested in pursuing a materials-related career. The scholarships are worth £250, which will be presented to the successful students at the beginning of their upper sixth year. If the student then carries on to study at one of the participating Universities the scholarship will continue. For further information about the scholarships and an application pack contact Carolyn Green, Armourers and Brasiers' CORUS Scholarships, Metallurgy & Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT. Telephone 0121 414 5175 or e-mail c.a.green@bham.ac.uk. *This is a not-to-be-missed opportunity for your students!*

Materials Summer Schools

During the summer term a large number of residential and day courses are on offer to both teachers and students. Here are details of a couple of these courses, both of which are supported by the Armourers and Brasiers'.

Materials Summer School The Royal Society of Chemistry is running a residential course at the University of Cambridge between the 11th and 14th of July. The courses consists of a mixture of lectures, practical activities and industry visits. For more information see the enclosed leaflet or contact Lorraine Hart, Royal Society of Chemistry, Burlington House, Piccadilly, London W1J 0BA. Telephone 020 7440 3350 or e-mail hartl@rsc.org.

What is Materials Science? The University of Birmingham is offering a residential course for students in Year 12 between the 8th and 10th of July. The course is designed to give students an insight in to Materials Science and Engineering and again features a mixture of lectures and lab classes. For more information see the enclosed leaflet or contact Carolyn Green, Metallurgy & Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT. Telephone 0121 414 5175 or e-mail c.a.green@bham.ac.uk.

Rolls Royce Materials Master Class

Once again this year Rolls Royce and the Armourers and Brasiers' are sponsoring a Materials Master Class for science and technology teachers consisting of two parts:

Part I A two day residential course in the Materials department at the University of Birmingham on Thursday and Friday, 23 and 24 September. This part of the course features lectures and hands-on laboratory classes covering the structure of materials, mechanical testing, microscopy, aerospace materials, sports materials, functional materials, smart materials and magnets.

Part II Company visit to Rolls Royce Derby on Thursday 02 October. The visit includes a tour of the production build line, the fuels and oils laboratory, the non-destructive testing and materials testing labs and also features a look in to electron microscopy and failure investigation.

The course fee is £30 which contributes to the cost of both parts, meals and overnight accommodation in Birmingham. If you would like further information and an application pack please contact Erica Tyson, Rolls-Royce plc, PO Box 31, Derby, DE24 8BJ or e-mail erica.tyson@rolls-royce.com

Materials for a Sustainable Society

The Schools Affiliate Scheme resource for 2004, Materials for a Sustainable Society, will be coming out to those schools that have already renewed this year very soon (it has been written over the Easter Holidays and has now gone to the printers).

As a quick reminder, the resource is based around the concept of a sustainable society and features short articles on themes such as:

- ❖ *Reuse or recycle – what to do with household waste?*
- ❖ *Sustainable energy for homes*
- ❖ *Sustainable fuels of the future*
- ❖ *An industry perspective on a sustainable society*
- ❖ *Modern biodegradable materials*

Following the articles there will be a number of suggested topics that can be used for class discussions and further research.

Future SAS resources

It's getting to the time of year when we are starting to think about the resource for next year (2005) and we would greatly appreciate your input on this matter.

What sort of themes would you like to see covered, what sort of format would you prefer the resource to be in (i.e. booklet, posters, CD Rom etc.)?

Previous resources have included

- ❖ *videos on the different groups of materials,*
- ❖ *samples of different materials,*
- ❖ *posters featuring various applications,*
- ❖ *a book of materials experiments,*
- ❖ *a book on magnetic materials*
- ❖ *a pack covering smart materials including samples.*

I am hoping to start putting the new resource together over the summer so if you have any ideas or comments please get in touch. You can e-mail me at diane.talbot@iom3.org or give me a call on 01302 320486. I look forward to hearing from you soon...

Schools Day at Materials Congress

Firstly, I would like to say a huge thank you to all those teachers and technicians (oh and not forgetting the pupil) that attended the event (it was great for me to be able to put faces to names) and a big welcome to those new schools that received membership of the Schools Affiliate Scheme on the day.

Materials Congress was the highlight of the calendar for the Institute this year and featured three days of technical sessions and workshops aimed at disseminating up-to-the-minute information about research in the materials, minerals and mining fields.

Wednesday 31 March was schools day at Congress and 32 of you came along to find out more. In the morning the technical sessions were open for teachers to attend. A large number of delegates attended the session on smart materials and smart packaging which most found relevant to their teaching and relevant for their CPD. Others attended sessions on platinum, surface engineering, biomaterials and nanomagnetism and found these equally useful and interesting.

After a very nice lunch the teachers were invited to my lecture 'Materials in Action', a similar presentation to the one I give in schools. The talk covered the uses of materials in aircraft engines, cars, sports equipment, medicine and communication and featured examples of metals, polymers, ceramics, composites and smart materials. An overwhelming majority of teachers thought the quality of the presentation and samples was excellent and almost all of you thought I was enthusiastic! Most were interested in booking me in school so I am expecting a flood of invitations in the near future!

We all feel that the event was a great success and would like to organise further events like this in the future. If you think it's a good idea too, let us know what you want and when you want it!

A final thank you to the Royal Academy of Engineering who sponsored the teachers event.

World Materials Day 2004

This year we are running a *poster competition* to support World Materials Day in November. The competition is open to schools, colleges and other youth groups and is split into two age groups: 13 to 16 (Class I) and 16 to 18 (Class II). Teams of up to four people must produce an A1 sized poster on one of the following themes:

- *Building the energy efficient home of the future*
- *Recycling household waste*
- *Transport for the modern world*
- *Bionic man - fact or fiction?*
- *Human performance versus materials technology - who is actually winning?*

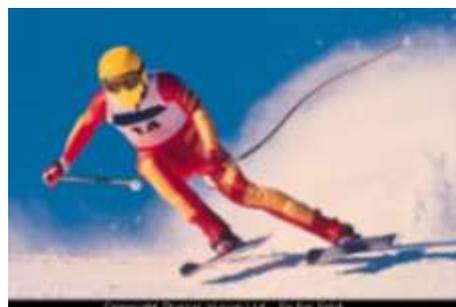
The posters will be judged on their structure, quality, technical content, conclusions and relevance to the chosen topic. Three posters from each class will be short-listed and invited to give a presentation based on their poster at our Head office, 1 Carlton House Terrace in London, on Monday 01 November 2004.

The school representing the winning team in each class will receive **£250** and each team member will receive Amazon vouchers to the value of **£15**. All of the schools attending the final will get membership of the Schools Affiliate Scheme for one year and certificates.

The winners of the UK competition will go forward to represent the UK in the international competition later in the year.

If you would like to find out more information about the competition and get an entry pack please contact Diane Talbot or Susan Longstaffe in the Doncaster office on 01302 320486 or e-mail diane.talbot@iom3.org or susan.longstaffe@iom3.org.

The closing date for entries is Friday 01 October 2004 and the short-listed teams will be notified by Friday 08 October 2004.



DIANE'S DIARY

After a completely mad spring term, the summer one looks like it might be a bit easier...

- 19/04 St Paul's School, Leicester
- 21/04 Brayton School, Selby
- 21/04 North Axholme School, Crowle
- 22/04 Techniquest, Cardiff
- 23/04 UCAS Convention, Cardiff University
- 26/04 Newquay Tretherras School
- 27/04 Ilfracombe College
- 20/05 Helston School
- 21/05 Liskeard School
- 26/05 The Long Eaton School, Nottingham
- 27/05 Walthamstow Hall, Sevenoaks
- 10/06 Rhymney Comprehensive
- 16/06 Harrow Teachers Centre
- 17/06 St Anthony's RC Girls' School, Sunderland
- 22/06 UCAS Convention, Keele University
- 23/06 Polymer Study Tour, Napier University, Edinburgh
- 24-25/06 UCAS Convention, Newcastle Telewest Arena
- 28/06 Polymer Study Tour, London Metropolitan University
- 01/07 Newent College, Gloucestershire
- 03/07 Polymer Study Tour, Manchester Metropolitan University
- 6-7/07 UCAS Convention, Sheffield Hallam FM Arena
- 08/07 South Bromsgrove High School
- 09/07 ASE National Science Technicians Conference, Manchester
- 05/08 Salters' Chemistry Camp, Manchester
- 18/08 Salters' Chemistry Camp, York

I am already taking bookings for next term. If you would like me to visit please get in touch as soon as possible as the diary fills up pretty quickly. In general I will be doing visits on Wednesdays, Thursday and Fridays.

Autumn Open Day Programme

Thank you those of you that have already expressed an interest in attending one of the events running this November.

Unfortunately we are still waiting for confirmation of dates from a number of venues, but we shall be sending information and booking forms out to all SAS members as soon as it becomes available. I hope this does not deter you from booking one of these highly informative and useful visits.

Just to act as a quick reminder the Universities opening their doors, free of charge, to support the teaching of the materials content in Advanced level Physics, Chemistry and Design Technology courses are: Birmingham, Cambridge, Imperial, Leeds, Liverpool, London Metropolitan, Loughborough, Manchester & UMIST, Newcastle, Nottingham, Oxford, Queen Mary, Sheffield, Sheffield Hallam and Swansea. Typical activities include mechanical testing (tensile and impact testing) and microscopy (optical and electron) and students will get the chance to investigate a wide variety of materials.

If you would like to pre-register your interest in visiting one of the above venues then please contact Diane Talbot on 01302 320486 or e-mail diane.talbot@iom3.org.

Evaluation of School Visits

From immediately after the Easter holidays we will be starting to evaluate the effectiveness of the school visits, initially by surveying teachers. This is to allow us to gauge whether the presentations and activities are meeting the needs of schools in terms of supporting the curriculum and promoting careers.

Now when you book a visit you will be asked to complete a pre-visit evaluation form to find out your expectations of the visit and your current knowledge of materials. Following the visit each teacher attending a talk will be asked to complete a post-visit evaluation form.

Ideally the completed surveys will be handed back to me at the end of the visit, however pre-paid envelopes can be supplied for you to return them to us at a later date.

We would be very grateful for your cooperation on this matter as it should help us to improve the service we provide.

Spider Silk

Having recently watched Spiderman and Eight Legged Freaks it got me wondering about spider silk and its potential uses. If Spiderman can use it to swing from building to building can we use it as an engineering material?

Spider silk is an extremely strong material, weight for weight it is stronger than steel. Combine this exceptional strength with superb elasticity and toughness, add the fact that it is biodegradable and you get an amazing material that spiders have been producing for millions of years.

Spiders produce seven different types of silk which they use for a variety of applications. The strongest is dragline silk which they use to anchor and



construct their webs. Capture silk is woven around the dragline spokes of the web. This is very sticky and can stretch three to four times its own length before breaking. They also use silk for wrapping prey (like cling film!) and wrapping their eggs.

But what is spider silk? Well it is a natural polymer of course! The fibres are made up from two proteins embedded in a jelly-like polymer. The polymer accounts for about 70% of the silk and the proteins stick to this in an ordered arrangement. The polymer makes the material elastic, while the ordered protein strands give it strength and toughness. The proteins and other organic chemicals are produced in the silk glands and these are mixed together in the correct proportions to produce the desired type of silk. The liquid polymerises and hardens as it passes through the spider's spinnerets

.It is thought that spider silk would be the ideal material from which to make bullet proof vests, ropes, thread from which to make seatbelts, parachutes and wear resistant clothing, car body panels and a wealth of applications in aerospace and space. Spider silk may also be of use in medicine where it will make improved thread for stitching, artificial ligaments and tendons, and supports for blood vessels.

The big problem is getting hold of sufficient quantities of the silk - spiders cannot be farmed like silk worms because they are too territorial. Scientists have turned to genetic engineering to solve this problem and have inserted the dragline silk-producing genes from spiders in to goats, such that they produce the silk proteins in their milk. The idea is that these proteins are collected from the milk and spun in to thread. Other scientists have adopted a purely man-made approach and are producing thread from synthetic proteins that is not as complex as the natural material but is hopefully as strong and tough.

If this problem of producing the silk in large quantities can be overcome then the uses of spider silk are endless. If however, there is a backlash against producing the genetically modified goats or the proteins cannot be harvested successfully, then human uses of spider silk may well remain confined to the pages of Marvel comic books!



PLATINUM

The Schools Day at Congress featured a technical session entitled 'Platinum - from cradle to grave' so I thought it might be quite nice for those who didn't attend to find out about this most interesting element.



- Ⓢ Platinum is a silvery-white precious metal with atomic number 78 and atomic mass 195.
- Ⓢ Platinum melts at 1768.3°C, boils at 3825°C and has a density of 21090kgm⁻³.
- Ⓢ The other elements in the platinum group of metals are ruthenium, rhodium, palladium, osmium, and iridium.
- Ⓢ Platinum was discovered in 1735 by Antonio de Ulloa in South America and by Wood in 1741. Its name derives from the Spanish word '*platina*' which means silver.
- Ⓢ A plentiful supply of platinum was discovered in the Russian Ural Mountains in 1822. Other deposits are to be found in Columbia, the USA and Canada.
- Ⓢ Platinum is found in nature alongside other platinum group elements and gold. Extraction from its ore is complex. Firstly the mixed ore is dissolved in *aqua regia* (HCl and HNO₃) resulting in H₂PtCl₆. The platinum is precipitated out using NH₄Cl to give (NH₄)₂PtCl₆ and platinum metal is obtained by burning this compound. Further purification of this platinum sponge can be achieved by repeating the process of dissolving in acid, precipitation using ammonium chloride and burning the resulting compound.
- Ⓢ Platinum is 35 times rarer than gold. If all the World's gold was melted it would fill more than 3 Olympic swimming pools. If the same was done with platinum it would barely cover your ankles!
- Ⓢ Platinum does not oxidise in air at any temperature, however it is corroded by the halogens, cyanides, sulphur and the alkalis. Its corrosion resistance accounts for many of its uses.
- Ⓢ Platinum is very ductile and malleable when pure. One gram of platinum can be drawn in to a wire nearly 2km long! Pure, malleable platinum was first produced in 1789 by the French physicist P F Chabaneau. It was made in to a chalice that was presented to Pope Pius VI.
- Ⓢ Platinum has a wide variety of uses ranging from jewellery to catalysts.
- Ⓢ Due to the inert nature of platinum it is used for wire and vessels used in the laboratory and corrosion resistant apparatus.
- Ⓢ Platinum is used in thermocouple elements and electrical contacts.
- Ⓢ Platinum is used to coat missile nose cones and jet engine fuel injectors as it has excellent high temperature properties.
- Ⓢ Platinum jewellery is very popular, if expensive. 95% pure platinum is used in jewellery. It does not tarnish and is hypoallergenic. It is often used in gem stone settings and the Hope Diamond and Star of Africa and both set in platinum.
- Ⓢ An alloy containing 76.7% platinum and 23.3% cobalt has excellent magnetic properties.
- Ⓢ Finely divided platinum is an excellent catalyst. It is used in the contact process to make sulphuric acid, for cracking oil, in hydrogen fuel cells and in catalytic converters in cars.
- Ⓢ Lumps of platinum are used in cathodic protection of ships and other ocean going vessels, as well as piers and pipelines.
- Ⓢ Platinum wire will glow red hot in methanol vapour, acting as a catalyst to produce formaldehyde from alcohol. This phenomenon has been used in cigarette lighters and hand warmers.
- Ⓢ Platinum containing compounds such as *cis-platin*, PtCl(NH₃)₂ have been used as effective anti-cancer drugs in the treatment of testicular cancer and leukaemia.
- Ⓢ Platinum is bio-compatible and is used in pacemakers and heart valves.
- Ⓢ In 1920 platinum was eight times more valuable than gold. Today platinum is in the region of \$886 per troy ounce compared to \$418 per troy ounce for gold.



This newsletter is written and edited by Dr Diane Talbot, Education Co-ordinator.
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