The Institute of Materials, Minerals & Mining

Schools Affiliate Scheme

Issue 26
Summer Term 2007

NEWS

Countdown to the summer!

Hello and welcome to the final newsletter for this academic year. As you can see the format has changed slightly, but you will still see all the usual features, including the element focus on the back, and my diary somewhere in the middle.

Speaking of my diary, the past two terms have been the busiest ever in terms of visits, and I am now fully booked for this academic year (unless you want to drag your students in during the half-term holidays!).

Things will be changing for the better from the Autumn Term, in that we are hoping to recruit two new members of staff to the Education Team in Doncaster. This will allow us to provide a better service to members and you should find it easier to book a visit! You can find out more about this and how on page 3.

Also in this issue you can find out more about the courses that are available for teachers over the next few months. If you have to teach materials and do not feel confident in this area I would strongly recommend that you try to get along to one of these as they are all excellent. Details are on page 2.

In terms of opportunities for your pupils, we will once again be organising the very popular November Open Day programme again this year, details on page 10.

New to this issue are the Minerals and Mining pages. Although this is an area which is limited in the general curriculum, schools still do offer courses in geology and there are some very good resources out there to support the teaching of this fascinating area. You can find out about Ecton Mine in Derbyshire on page 9.

This is the first issue in this format and the features are by no means set in stone. If you have any comments on the articles or have ideas for new features please get in touch, I would love to hear from you. This newsletter is for you and I would like to ensure that every page is relevant! You can e-mail your suggestions to Diane.Aston@iom3.org.

This newsletter is written and edited by
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The next few months are a busy time for courses for teachers. Here are details of a selection of courses on a materials theme that will be running during the Summer and Autumn terms.

Polymer Study Tours

These successful three and a half day residential courses have now been running for twenty years and over 1700 teachers have attended during that time. The courses, which are equally relevant to both science and technology teachers, are running at two venues across the UK, Napier University in Edinburgh (17 to 20 June) and London Metropolitan University (24 to 27 June). Unfortunately the course that was planned to run in Bradford has had to be cancelled They are designed to improve the delegates knowledge and understanding of polymers in particular, and this is achieved through lectures, workshops and industry visits. Lecture topics polymer applications, polymer processing and product design. The issue of recycling and sustainability is tackled through a talk and discussion. Polymer testing ideas that can be used in schools are provided and delegates get an insight in to the real polymer industry through a full day visit to a local polymer company.

The cost to attend the course is £100, though this is only a small contribution towards the real cost per delegate of £700, the remainder is paid for through generous sponsorship.

If you would like to find out more about the Polymer Study Tours or apply to attend one of this year's events you can find details at www.ase.org.uk or www.horners.org.uk. Alternatively you can find full details in the leaflet enclosed with the newsletter.

The Science of Materials Summer School

This course is organised by the Royal Society of Chemistry with support from ourselves and sponsorship from the Worshipful Company of Armourers and Brasiers. The aim is to introduce chemistry teachers to materials science and features lectures, workshops, visits and ideas to take back in to school.

The course will be running from the 9th to the 12th of July and will involve working in the materials department at Imperial College and Queen Mary, University of London, and in the Polymer Centre of London Metropolitan University.

The programme takes advantage of the research specialities of each university. At Imperial College there will be a range of practicals and seminars on polymers and glasses, and fuel cell technology. At Queen Mary the day will be focussed on biomaterials (including the chance to replace a hip joint!) and the time at London Metropolitan University will be based around a processing, testing and characterisation of polymers. In addition there will be visits to the Victoria and Albert Museum and National Gallery where experts will takes delegates behind the scene.

There is a fee to attend this course and for more information please contact Lorraine Hart at the RSC hartl@rsc.org or 020 7440 3350.

Rolls Royce Materials Master Class

This two part course has been running for a number of years now and gives science and technology teachers an introduction to materials and their use in the aerospace industry. The first part of the course takes place in the Materials Department at the University of Birmingham on the 27th and 28th September. During the course the delegates attend lectures and lab classes covering all aspects of materials and their applications

The second part of the course on 16 October is a works visit to the Rolls Royce plant in Derby, where jet engines are made. I can strongly recommend this part of the course as it gives a real insight in to this very high-tech area of manufacturing.

This course is sponsored by the Worshipful Company of Armourers and Brasiers', so the cost to delegates is only £30, which includes accommodation and meals during the stay in Birmingham.

Further information and a registration form are enclosed with the newsletter, alternatively you can contact Erica Tyson at Rolls Royce directly at erica.tyson@rolls-royce.com

Staffing changes in the Education Team

Over the past six years or so the Schools Affiliate Scheme has thrived and visits to schools around the country are now very much in demand. When I took on the role of Education Co-ordinator in October 2001 there were around 200 member schools and visits had never been done on a consistent level. In my first year in this role I spoke to something like 2300 students in the whole year. From September to December 2006 I spoke to almost 4000 students alone and as many of you will know, it has become increasingly difficult to book a visit as my diary books up so far in advance and so quickly!

Over the past couple of years we have been sending out evaluation forms after every visit to gather feedback on the relevance and effectiveness of the visits and I am pleased to report that the comments have shown that this is a very worthwhile activity. There have also been a number of mergers with other Institutes in recent years which have expanded our subject area to include Minerals and Mining Engineering, Packaging and Clay Technology.

With this is mind The Institute consider the Education team should be expanded so that a better service can be provided to our members. We are hoping to recruit two new members of staff ready for the start of the new academic year. The first will be a part-time role covering the minerals and mining related areas of the curriculum. The second will be another full-time person to work on materials with me. So with two people doing visits you should find it much easier to book.

If you are thinking about a bit of a change of direction you could consider applying for one of the posts. The job adverts have appeared in Materials World and the TES, but just in case you missed them they are below.

The Autumn Term issue of the newsletter will update you on our progress and hopefully introduce the new members of our team.

The Institute of Materials, Minerals & Mining – Education Team

The Institute of Materials, Minerals and Mining is expanding its Educational and activities and is seeking candidates for the following vacancies:

Education Co-ordinator (Materials) [Full-time] and Education Co-ordinator (Minerals & Mining) [Part-time]

An exciting and demanding opportunity to work alongside the current Education Co-ordinator to take lead roles in the delivery of The Institute's Schools Affiliate Scheme and secondary school educational activities.

Successful candidates will need to have the necessary understanding and knowledge of the materials, minerals and mining subject areas to create innovative approaches to increasing engagement, which will reflect and encompass the Institute's strategy as a whole.

Closing date for all applications is **Friday 25 May 2007.**

For further details and job descriptions contact Dallas Dinsmore, Personnel, Institute of Materials, Minerals & Mining, 1 Carlton House Terrace, London SW1Y 5DB. Tel. 020 74517364 e-mail: dallas.dinsmore@iom3.org

New Features

This is the first issue of the newsletter in this format and I would be very grateful for your comments. This could be on the content - do you like the new pull-out section in the middle? is there a particular topic that you would like to see explained? Do you like the new minerals and mining pages?

Or it could be on a more practical level – do you like the new A5 format? is the font size too small? I would also like to introduce more new features. Perhaps you would like to write an article about my visit to your school (or get a student to do it) Maybe one of your students has used a particularly interesting material in a D&T or physics project and you would like to tell others.

Your comment will be used to improve future issue so please get in touch by e-mailing diane.aston@iom3.org.

Diane's Diary

The Spring term was very busy and the summer term is shaping up to be just as hectic. Here's where I will be…

April		June	
17	Newquay Tretherras School	05	Sacred Heart School, Newcastle
18	Plymouth High School for Girls	06	Farringdon School, Sunderland
19	Richard Lander School, Truro	07	Queen Ethelburgas College, nr York
20	Helston School	08	St Edwards Middle School, Leek
24	Our Lady Queen of Peace School, Skelmersdale	11	*Spennymoor School, nr Durham*
25	Painsley RC College, Cheadle	12	Ecclesbourne School, Duffield
26	La Sainte Union School, London	13	St Edwards Middle School, Leek
27	Queen Ethelburgas School, nr York	14	Easington School,
30	Hereford Cathedral School	17	Napier University Polymer Study Tour
May		18	Merchant Taylors Girls School, Liverpool
01	UCAS Fair Newcastle	19-20	UCAS Fair, Liverpool
02	Sir Bernard Lovell School, Bristol	22	St Olaves School, York
03	Barclay School, Stevenage	24	LMU Polymer Study Tour
04	Derby High School	25	St Mark's Catholic School, Hounslow
08	Millom School, Cumbria	27	Derby High School
09	Sandbach School, Cheshire	28	Ysgol Tregib, nr Swansea
10	National Science Learning Centre, York	29	Techniquest, Cardiff
11	Bryanston School, Blandford Forum	**July**	
14	Lutterworth Grammar School	03	UCAS Fair, Sheffield
15	Our Lady Queen of Peace School, Skelmersdale	04	Prestatyn High School, Techniquest event
16	Queen Elizabeth's Grammar School, Penrith	05	Alleyne's High School, Stone
18	Braunton School, Devon	06	ASE Science Technicians Conference,
22	Kirk Balk School, Barnsley	*Schools in italics are provisional bookings and we are awaiting the return of a completed signed booking confirmation form*	
23	The Avon Valley School, Rugby		
24	Westminster Kingsway College, London		
25	Robert Pattinson School, Lincoln		

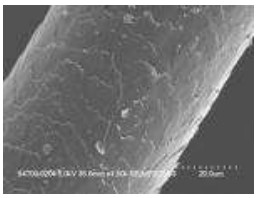
Provisional bookings are already being taken for the Autumn Term and there are still a number of dates available. We will once again be giving schools that have never had a visit before priority on certain dates. If you would like the most up to dates list of the remaining dates available please get in touch by e-mailing diane.aston@iom3.org.

NANOTECHNOLOGY – the stuff of science fiction or science fact?

If like me you are old enough to remember films like Inner Space you might think that nanotechnology is the stuff of science fiction. However, nanotechnology is a very hot topic at the moment and a field which could radically change our technology (whether that is for the better or not is something that is as yet largely unknown).

What is nanotechnology?

Nanotechnology or nanoscience or nanomaterials is basically a study of the design, characterisation, manipulation, production and application of materials on the nanoscale, that is to say materials that are on a scale of a few billionths of a metre or millionths of a millimetre (typically 1 to 100nm in size). To put this into context one nanometre (nm) is about the same as ten atoms in a line (so each has a diameter of about 0.1nm) and a human hair is about 80,000nm thick. Rather than being a new subject in its own right the nano-discipline is simply an extension of existing subjects (physics, chemistry, biology, engineering and materials science), concentrating on the behaviour and use of substances on a tiny scale.



Scanning electron micrograph of a human hair

When working on such a small scale the building blocks are individual atoms and molecules and macroscale phenomena such as inertia and turbulence are replaced by surface effects, as the materials have a dramatically increased surface area to volume ratio. Nanoparticles are governed by Van der Waals forces, atomic bonding (ionic, covalent and hydrogen bonding), electronic charge and quantum effects, which means that they often display very different properties to the same materials on the macroscale. Some interesting examples include:

Material	*Macroscale property*	*Nanoscale property*
Aluminium	Stable	Combustible
Copper	Opaque	Transparent
Gold	Solid at room temperature	Liquid at room temperature
Platinum	Inert	Reactive
Silicon	Insulator	Conductor

This is a fascinating area of research and has the potential to make an impact on our everyday lives in many different ways, yet some groups are concerned about the risks involved in working with materials on such a small scale as we know so little about how they will behave.

How long has nanotechnology been around?

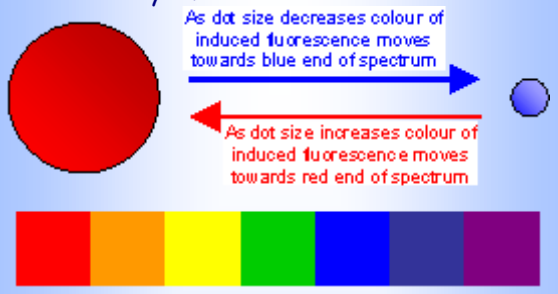
Nanotechnology isn't really anything that new. Nanoparticles or nanostructures have existed in nature for millions of years. The enamel on teeth is made up from natural nanocrystals, some crystalline sponges have very efficient nano-lenses and it is the nanoscale forces generated between the minute hairs on a gecko's feet that allow it to hang upside down from seemingly smooth surfaces. Other natural nanomaterials include proteins which control and regulate biological systems, spider silk which is stronger than the equivalent diameter steel wire and water-repelling plant leaves.

However, scientists and engineers have been working with materials on this small scale for many years too. Stained glass and ceramics dating back to the 10th century have been found to contain coloured pigments based on nanoparticles of gold and silver. Gold particles can appear red, blue or gold depending on their size! In more recent times nanotechnology has been used to build large molecules from much smaller nanomolecules – we commonly call such large molecules polymers, materials that we all take very much for granted. The microchips at the heart of our computers are made by processing silicon on the nanoscale and this technology has been around for some 20 years.

The first time the concept of nanotechnology or nanoscience was distinguished from general or conventional science and engineering was in 1959, when Richard Feynman described how precise tools could be developed to manipulate individual atoms and molecules. However, it was not until 1974 that the term nanotechnology was defined by Professor Norio Taniguchi from Tokyo University who described nanotechnology as 'consisting of the processing, separation, consolidation and deformation of materials by one atom or one molecule'. The field really started to develop in the early 1980's with the birth of cluster science and the development of the Scanning Tunnelling Microscope (STM). In 1986 fullerenes such as C60 were discovered *(I remember reading about the discovery of Bucky Balls in New Scientist when I was just 12 years old and I thought the whole concept was mind-blowing! Perhaps that helped to inspire my passion for all things materials…)* and the synthesis of semiconducting nanocrystals was investigated leading to the development of quantum dots (see box below). Nanotubes, nanowires and nanoparticles, have now been developed and are under investigation for possible uses in many everyday areas, including construction, communication, medicine and even cosmetics.

Joining the dots to light up the future

Quantum dots can also be called semiconductor nanocrystals or even artificial atoms and they are tiny crystals whose size is on the nanoscale. A quantum dot has a typical diameter of 2-10nm or 10-50 atoms and may contain 100-100,000 atoms in total! The term artificial atom arises because quantum dots have discrete energy levels in much the same way as atoms, and these energy levels can be changed and controlled by varying the size and shape of the quantum dot (i.e. how many real atoms it contains). When light is shone on a quantum dot the electrons within it become excited and re-emit light at a wavelength which depends upon its size. The intensity of the fluorescence can be thousands of times brighter than that produced using conventional dyes.



Quantum dots have excellent transport and optical properties and are being investigated for use in biological sensors, amplifiers and diode lasers. Until the blue quantum dot laser was developed it was thought that using a blue laser for reading digital information was impossible. Now such lasers are being used in the new Playstation 3 (Blu-ray technology) and high definition DVD players (HD DVD). In the future quantum dots may allow solid-state quantum computing. It is also likely that quantum dots will have a role to play in medicine, particularly for imaging inside the body and perhaps detecting tumours.

How are nanomaterials made?

In the late 1800s it was possible to synthesise nanoscale colloidal materials, but nanostructures have only been practically possible since the late 1980s. Making and measuring nanomaterials has only become a reality as tools for working on such as small scale have been developed. The atomic force microscope (AFM) and scanning tunnelling microscope (STM) have allowed us to not only see, but work with materials on the nanoscale.

There are two distinct approaches for making nanomaterials. In the top down method a bulk material is reduced in size to a nanoscale, whereas in the bottom up approach large structures are built up or grown atom by atom to produce the nanomaterial or nanostructure.

In top down processes, scanning probes such as those found in the AFM and STM can be used to manipulate nanostructures, but the process is very slow. Nanolithography, electron beam lithography and nanoprint lithography have allowed the process of reducing bulk materials to the nanoscale to be speeded up considerably.

Bottom up technologies, such as chemical synthesis, self-assembly and positional assembly are very slow as they involve building up large structures one atom or molecule at a time.

Where might nanomaterials be used?

If you believe all you read then you may be under the impression that nanotechnologies could revolutionise every aspect of the way we live our lives.
Nanomaterials have very distinct properties and their fabrication is becoming increasingly possible on a practical level. Nanomaterials have the potential to benefit many areas of our technology including their use in the following…

In the communications industry

Nanotechnologies have been used in the communications industry for many years with the materials being processed using top down techniques. The gate length of transistors in CPUs and DRAM devices is already on the nanoscale (50nm or less). Nanostructures have been used to improve the data storage density of hard discs and create non-volatile main memory for computers. Optical or optoelectronic devices are increasingly replacing traditional analogue electronic devices. Photonic crystals resemble semiconductors but use light or photons instead of electrons and quantum dots are being used in the construction of lasers. Carbon nanotubes could be used in field emission displays which work in a similar way to a cathode ray tube, but on a much smaller scale and with a much lower energy consumption.

In construction

Nanomaterials such as carbon nanotubes offer tremendous strength for their size. The use of these in composites instead of carbon fibres could allow much larger, lighter structures to be built. This could include less bulky suspension bridges which could span larger gaps (for example joining Europe and Africa across the Straits of Gibraltar).

In cosmetics

Probably the most well known use of nanotechnology in cosmetics in sun screens. Traditional chemical UV filters suffer from poor long-term stability, thus the need to reapply at regular intervals. Nanoparticles of titanium dioxide show comparable UV protection to conventional screens, with the advantage that they are transparent. Nanoparticles are also being used in creams which claim to penetrate deeper in to the skin and slowly release vitamins or other agents to reduce the appearance of the those tell-tale wrinkles!

In the energy industry

Nanotechnology may be used in the efficient production of 'green' energy and in reducing our overall energy consumption by increasing efficiency.

LEDs based on nanomaterials are far more efficient and last much longer than conventional light bulbs, which only convert 5% of the electrical energy to light. You may notice that many new sets of traffic lights use LEDs rather than conventional bulbs and as well as offering a tremendous energy saving they produce a very bright light and require far less maintenance.

The best solar cells available at the moment contain layers of two different semiconducting materials stacked together to absorb light at different energies. These are only 30% efficient and commercially available systems are even less efficient, only 20%. Specifically designed nanostructures have the potential to increase the efficiency of solar collectors dramatically. Nanoparticles can be used as surface catalysts on combustion engines to increase efficiency and it may be possible to use coatings made from nanomaterials to turn every rooftop in to a solar energy collector.

A hot topic in terms of energy production at the moment is the hydrogen fuel cell. These could be used to generate electrical energy for use in the home, to power vehicles or even hand held electronics gadgets like mobile phones. One big drawback with these fuel cells is the storage of the hydrogen prior to its and this is where nanotechnology could offer a practical solution. Nanoporous materials such as nanotubes, zeolites and alanates are possible candidates. In more conventional engines nanomaterials can be used as filters or in catalytic converters to remove pollutants from exhaust gases.

In medicine

Terms such as biomedical nanotechnology or nanomedicine have been used to describe the use of nanotechnology in the medical field. It is thought that nanomaterials will be able to be used in a number of applications as they are of a similar size to most biological molecules. In imaging nanoparticles can be used as contrast agents or markers. Quantum dots have been used instead of conventional dyes to watch blood flow in the tissues of mice. The images produced were detailed enough to be able to show the walls of the blood vessels rippling as the heart beated. By adding antibodies or other molecules to the dots it is possible to target them very specifically and image the results to label and track cells or even identify cancerous tissues. Nanoporous materials, nanoparticles or nanomolecules like Bucky balls or dendrimers may be used to encapsulate drugs and transport them to a particular site within the body.

This highly selective approach means that the drugs are only deposited in the required area, reducing overall consumption, potential side effects and cost.

Tissue engineering uses man-made materials as a support or scaffold for new tissue to grow on. These scaffolds can be made using suitable nanomaterials which are impregnated with cells which are artificially stimulated to grow. Many hospitals are already using tissue engineered skin in burn victims as it eliminates the need for a graft which can in itself be very painful and lead to scarring. Tissue engineering is one way of reducing the risks associated with conventional artificial body parts or organ transplantation, however it is not without its own risks or controversy. It is closely linked with the debate over the ethics of stem cell research, as one way of obtaining the tissues which are used with the man-made scaffolds is from stem cells.

Outside the body nanotechnology can be used in medical diagnostics. When nanomaterials are used as tags or labels in biological tests to identify or measure the presence and activity level of a particular substance the results can be obtained faster and they are more sensitive.

In textiles

The fabulous stain-repelling, crease-free clothes that are now available (particularly for school uniforms and trousers like those pictured to the right!) rely on nanoscale surface coatings. These coatings are simply made from a polymer which has hydrophobic sections which orientate themselves perpendicular to the textile surface and repel water, so that a spill will simply bead on the surface rather than soak in.

What are the risks associated with nanomaterials?

As this area of technology is still pretty new, no-one really knows exactly what the associates risks are. However, the potential risks can be split broadly in to three areas, risks to our health and environment, risks associated with molecular manufacturing and risks to society.

It is the mobility and increased reactivity of nanomaterials that pose a potential risk to us. It is free nanoparticles (those that are not part of another material) that could be dangerous. We do not know what will happen if these are unintentionally inhaled or introduced in to the body. Similarly we do not know how the release of these materials into the environment will affect specific ecosystems. The 'Grey Goo' scenario, where self-replicating nanorobots turn the whole surface of the planet in to this substance, is very unlikely to happen in reality! In terms of the risks to society, military uses of nanomaterials are thought to be the most realistic.

As with all new areas of research and technology international bodies are in place to regulate these materials and oversee future applications.

What is the future of nanomaterials?

Without a doubt nanomaterials are a hot topic of research and discussion in the science and engineering communities. It is likely that these materials will continue to be introduced slowly and to an extent silently into our everyday lives and as with most new materials, improve the technology which we take for granted and rely on every day.

Where can I find out more information?

There is loads of information about nanomaterials and nanotechnology out there in cyber space. In the writing of this article I found the information on Wikipedia very useful indeed. You can also find out about nanotechnology on howstuffworks.com which has a great list of links to organisations such as NASA (looking at nanogears). The Institute of Physics web-site has an excellent article on this topic

If you are looking for a paper resource that you can use in the classroom the Wellcome Trust have produced a booklet on nanoscience as part of their Big Picture series. These are available from www.wellcome.ac.uk/bigpicture where you can subscribe to receive one free copy of each issue, or purchase class sets for a small charge.

Ecton Hill Field Studies Association

Enhancing Advanced level Chemistry and Geology Courses

Earlier this year in March I had the opportunity to go to the re-launch of the Ecton Hill Field Studies Association (EHFSA). I had a fantastic afternoon exploring Ecton Mine with a trained guide and I learned loads about the geology of the area which I found fascinating. The EHFSA will be running courses again from June this year and I would strongly recommend taking your pupils to this most beautiful part of the country. Enclosed with this newsletter you should find details of the Centre, but here is a potted history…

Who are the EHFSA?

The Ecton Hill Field Studies Association (EHFSA) is a voluntary association that has run one-day tutored courses for AS and A2 Chemistry and Geology students since 1991.

Each course is led by two volunteer tutors, who are experienced chemistry and geology teachers, both serving and retired. They all share an enthusiasm for the value of these one-day courses for student motivation and enhancement of learning. They are also experienced in leading fieldwork groups safely, including the underground activities inside the mine. All the tutors hold current enhanced CRB clearance.

What do the EHFSA do?

EHFSA courses match both present A level specifications and the new A level specifications from September 2008. The copper mine context is used to bring to life a variety of chemical and geological topics in the A level specifications in an exciting and memorable experience for Y12 and Y13 students. Practical work out-of-doors is a feature of all courses, (but with an indoors option should the weather be too inclement!). For 2007-2008, they are concentrating their efforts on A levels in these two subjects. They hope to develop courses suited to GCSE specifications, and these will be publicised when available.

Courses are available in selected weeks only, on both weekdays and weekends, in order to match tutor availability to requirements of schools, both in terms of A level course timing and of planning out-of-school experiences.

The cost per student is kept to the minimum needed to cover the expenses of running the courses. At present the cost is £10 per student, but this is subject to review later this year.

Where is the EHFSA?

The G A Cox Educational Centre is situated at Ecton in the Manifold Valley in the Staffordshire Moorlands part of the Peak National Park, near the villages of Warslow and Hartington.

The mine itself is now owned by the Ecton Mine Educational Trust, hopefully ensuring a stable future for this fascinating historical copper mine. The copper and lead deposits on Ecton Hill were worked for over 3500 years, ceasing in 1891. During this time fortunes were made and lost. In its heyday in the late eighteenth century, this was probably the largest copper mine in Europe. Ecton was in the forefront of developments in mining technology. It is claimed that the use of explosives for mining in Britain was pioneered here at Ecton in 1668. Both Chemistry and Geology themselves developed rapidly as a result of these advances in technology. The whole area is a Site of Special Scientific Interest (SSSI), and the Ecton mine itself is an underground SSSI. The rock exposures at nearby Ape's Tor provide outstanding opportunities for the study of geological structures, which can then be seen again underground in Salt's Level.

Where can I get more information?

For more information about the EHFSA look on the web-site, www.ectonhillsfsa.org.uk, alternatively if you would like to book a course please contact Anita Horton, anita.horton@iom3.org

SAS Resources Update

Hopefully you will all have been pleased with the resource for 2006 that we sent out just before Christmas. Feedback on the posters has so far been very positive.

The resource for schools joining the Scheme or renewing their membership in 2007 will be the Packaging resource that we had planned for 2006. Packaging is an area on which we are all completely reliant, yet we take it very much for granted. Throughout the development of packaging an understanding of materials and how they are processed has played and continued to play a key role. Modern packaging must be able to be mass produced cheaply and transported around the world at low cost. Polymers, metals, ceramics and paper continue to be used for packaging our food and other products. In recent years smart materials have started to be used in packaging. From thermochromic panels on chocolate bars to sensors on packaging which change when the food is starting to decay. Recycling is also becoming much more important when designing and producing packaging. We cannot keep putting our waste in landfill, so ways of reducing the amount of packaging we use and recycling as much of this as possible must be developed. The '***Packaging the Facts***' booklet looks at packaging from all angles, covering why packaging is important, its history, the materials used and processing techniques, modern packaging materials and methods and recycling.

This resource will be going out to member schools at the beginning of September to coincide with the start of the new academic year. However, if you have renewed your membership in the months prior to this you will still be able to make full use of the other benefits, such as a visit to your school, the newsletter, Materials World and an open invitation to attend the meetings of your nearest local society.

For 2008 we are hoping to put together a resource on a minerals and mining theme, to coincide with the re-opening of Ecton Mine (see page 9) and the new Smallpeice courses at Leeds and Exeter. At the moment the format and content of this resource have not been finalised, so if you have any suggestions for what you would like to see included please get in touch (diane.aston@iom3.org).

Your Education Committee Needs You!

The Institute of Materials, Minerals and Mining Education Committee is a body made up of school teachers, university academics and industrialists and others with a vested interest in the materials, minerals and mining areas. The Committee meets three or four times a year to discuss all aspects of the Institute's education activities and advise on the development of new resources and initiatives. The Committee has recently got a new Chair, Dr James Marrow from the Manchester Materials Science Centre, and we are now looking to recruit new members, particularly from the school community. If you are a science or technology teacher and you would like to contribute your opinion, please get in touch (diane.aston@iom3.org) and I will send you the minutes of the last few meetings so you can see what we have been discussing. Reasonable travelling expenses are paid to attend the meetings and the cost of supply cover for teachers is also covered.

November Open Days - Advance Notice

Just a quick note to let you know that we will once again be co-ordinating a series of open days in November aimed at supporting the teaching of the materials topics in advanced level courses in physics, chemistry and design technology. Last year events were held in the Materials Departments at Birmingham, Cambridge, Imperial, Liverpool, Loughborough, London Metropolitan, Manchester, Newcastle, Oxford, Queen Mary (London), Sheffield and Swansea and it is hoped that the same venues will be available this year.

At the moment we are awaiting confirmation of dates from the Universities and as soon as these are in the information and registration forms will be printed and distributed. We hope that these will be with you by late May so you can start planning your visit when you get your timetable.

Resources and Support from the Armourers and Brasiers

You might have gathered from some of the earlier articles that the Worshipful Company of Armourers and Brasiers are very committed to the support of materials science, but do you know who they are and what else they do?

The Armourers and Brasiers are one of the original Livery Companies of the City of London. Now there isn't much demand for armourers (people that make armour), the companies charitable aim is directed towards the modern equivalent, that is, materials science.

The Company takes a special interest encouraging materials-related teaching in schools and they support a wide range of activities and resources associated with this area, along with a number of partner companies and organisations.

Enclosed with this newsletter you will find a full list of the activities they support, however, I felt it was worthwhile picking out a few of them.

Taster courses and summer schools for students

In addition to the courses for teachers that are supported by the Company, the Armourers and Brasiers also support courses for schools students. These include residential taster courses in materials science for sixth formers held at the University of Birmingham (for more information contact Dr Mike Jenkins, m.j.jenkins@bham.ac.uk), materials science activities within a number of Salters' Chemistry Camps across the UK for 15 year olds (for more information contact Emma Rainbow, camps@salters.co.uk) and a materials specific Headstart course at Oxford (for information contact Dr Martin Carr, martin.carr@materials.ox.ac.uk)

Armourers and Brasiers / Corus Sixth Form Scholarships

These scholarships are offered to students in year 12 who are interested in possibly pursuing a materials based course a at university. Ten scholarships of £350 each will be made in September 2007 to students entering year 13. If the students go on to study a materials based course at one of the participating universities (Birmingham, Cambridge, Imperial, Leeds, Liverpool, Loughborough, Manchester, Oxford, Queen Mary, Sheffield and Swansea) then the scholarship will continue at a level of £350 for the duration of their BEng or MEng course. The scholarship scheme is administered by Dr Mike Jenkins and Carolyn Green in the Materials Department at the University of Birmingham. For more information contact them at m.j.jenkins@bham.ac.uk or c.a.green@bham.ac.uk or telephone 0121 414 5175

Why study materials?

This is not an article in which I am going to preach about how wonderful and interesting materials courses are or tell you about the wealth of exciting, challenging and rewarding careers that are out there for your students at any level in this field. I could go on about that for pages! No, I want to tell you about a new web-site launched by the UK Centre for Materials Education (UKCME), based in Liverpool.

The site is split in to two sections, the first is packed full of information for students. This includes a list of course providers and careers information, a really good explanation of the subject and a large number of case studies looking at the use of materials in everyday applications. These include mobile phones supercars, biomaterials, space craft, , football boots and many others. There are two great quizzes designed to test the students knowledge of materials and they are well written and easy to follow.

In the second section the information is geared towards teachers. There is the ability to search the UKCME's materials resource database and a full list of contacts at the universities with materials departments for the purposes of open days, the ideal chance to have a look at materials in action in world class research establishment

There is also a news section which has links to current news articles on a materials theme. There is a contact age in which you can send your materials question to the team of experts who will post the answer on the site. A list of previous questions and answers is also available. Finally there is a competition to enter and win prizes!

If you would like to have a look at this excellent site for yourself you can find it at www.whystudymaterials.ac.uk

Tin

- The Latin name for tin is *Stannum* and this is the origin of it's chemical symbol, Sn. The name Tin is an ancient Anglo-Saxon word.
- Tin can be found in the periodic table at number 50 and it is defined as a poor metal. Poor metals or post-transition metals are those metallic p-block elements that have lower melting and boiling points than the transition metals but high boiling points than the neighbouring metalloids. This small group also includes aluminium, gallium, indium, thallium, lead and bismuth.
- Tin melts at the relatively low temperature of 232ºC, and boils at 2602ºC (which is below the melting point of tungsten!). It has a density at room temperature of 7.310kgm^{-3}, making it almost as dense as iron.
- Tin is ductile and malleable and is a highly crystalline silvery-white metal. It is resistant to oxidation in air and resists corrosion in sea water, distilled water and tap water (provided it is not really hard). It can be attacked by strong acids, strong alkalis and acid salts.

- Tin has been known since ancient times. It's low melting point meant that it could be smelted in a wood fire. It is a constituent of bronze and early bronze implements date as far back as 3500BC. It is also one of the main ingredients of pewter.
- In the UK the main deposits of tin were found in Devon and principally Cornwall. The last tin mine in Cornwall, near Camborne, closed in 1998, bringing nearly 4000 years of tin mining in the area to an end.
- Tin is now mined in around 35 countries world-wide and the main ore is *cassiterite* which is tin oxide (SnO_2). The metal is extracted by reducing the ore with burning coal.

- Tin has two allotropes. Grey tin, which has a cubic structure, changes to white tin when it is warmed to 13.2ºC. White tin is the normal form of the metal and has a tetragonal structure. On cooling back through 13.2ºC it will revert to the cubic form. This phase transformation can be affected by adding small additions of other metals such as aluminium and zinc and can be prevented by adding small quantities of antimony or bismuth.
- Tin is available in various forms (granules, ingots, wires etc.) and has many uses. One of the most well know is as a corrosion resistant coating for other metals such as iron and steel. Tin plated steel cans have been widely used for storing different foods.

- Important tin alloys include bronze, pewter, bell metal, phosphor bronze and solder. Lead-tin solders have been important for joining pipes and in electrical circuits for many years. The toxic properties of lead have now meant that solders are pure tin, or tin alloyed with other less toxic materials.
- Tin is the most tonally resonant of all the metals and lead tin alloys were traditionally used for making organ pipes. The composition of the alloy dictates the tone of the sound produced.
- Window glass is made by floating the molten glass on the surface of molten tin in the Pilkington Process. This process was developed in 1952 by Sir Alastair Pilkington.
- Up until the early 1900s tin foil was used for wrapping food. Aluminium foil is now used but the phrase tin foil is still widely used.
- At temperatures below 3.72K tin becomes a superconductor and the Meissner Effect was first discovered in crystals of tin. One niobium-tin compound has a critical temperature of 18K and it can be used to make wires for superconducting magnets.
- When a small bar of tin is bent it can be heard to make a characteristic 'cry'. This is the sound produced as the crystals in the material deform. You can download a clip of tin crying from www.theodoregray.com/PeriodicTable/elements/050.

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