schools affiliate scheme

news

Issue 40

Spring & Summer Term 2012

In this issue:

CONNECTING TEACHERS TO THE WORLD OF MATERIALS, MINERALS AND MINING

CHANGE IS AFOOT!

I am the bearer of good news! For the last twelve months I have been busy writing proposals and attending meetings to discuss the sustainable future of the Schools Affiliate Scheme. In March the proposal put forward by our Education Committee was approved by Council, the Institute's governing body, and the new improved **free** Schools Affiliate Scheme will be launched in September. You can read all about the new Scheme on page 3.

I do have an apology to make too. All of the work involved in getting the proposal ready and through various committees meant that the Spring Issue of the Newsletter was delayed so I hope you enjoy this combined Spring & Summer edition! Enclosed you can find out all about upcoming courses for teachers and students, all of which have space left for that last minute booking.

In order to get this issue out to you without delay the technical article features, on graphene and composites, have not been included, but they are available to download as PDF files from the website (www.iom3.org/sas). This issue does have information on a project that has been shortlisted for the 2012 Rolls Royce Science Prize which aims to raise awareness of materials science and engineering and encourage students to consider a career in materials.

The changes to the Scheme mean that this will be the last printed version of the SAS newsletter. In some ways this is the end of an era, but I hope that it is also the start of something bigger and better and I hope that you will continue to enjoy the regular features on-line. Have a great summer and don't forget to catch up on the website in the autumn!

The Institute of Materials, Minerals and Mining

This newsletter is produced by Dr Diane Aston, Training and Education Executive.
If you have any comments or articles please contact Diane by emailing Diane.Aston@iom3.org or write to her at The Institute of Materials, Minerals and Mining, Grantham Regional Centre, The Boilerhouse, Springfield Business Park, Caunt Road, Grantham, Lincolnshire, NG31 7FZ

Typical activities

The exact nature of the activities varies from venue to venue, but they are all designed to give students a greater insight into the world of materials and link in with the curriculum.

Typical activities include:

- Mechanical testing. Tensile testing and impact testing of a range of materials to look at how properties are related to structure.
- Optical and electron microscopy. Students will be able to view materials on a range of scales.
- General introductory lecture on materials and their uses.
- Special sessions on biomaterials, smart materials, nanomaterials, magnets and forensics.

If you would like to know more about the activities at a specific venue please contact me.

Once you have booked you can contact the member of staff in the department to discuss your exact requirements so that the session can be tailored to your specific needs.

For more information please contact Diane Aston on 01476 513882 or diane.aston@iom3.org

AUTUMN OPEN DAY PROGRAMME 2012

Do you teach Physics, Chemistry, Design & Technology or Engineering at post-16 level?

Would you like the opportunity to take your students out of the classroom for a chance to perform experiments in world class research facilities?

Well, if you answered yes to either of these you need to take your students along to one of the Autumn Open Day Programme events happening at a university near you.

We have been working with the materials departments around the UK for many years now to put on a programme of events that is specifically designed to enrich the teaching of materials in post-16 courses. You will have access to equipment not normally available in school and experts in materials that your students can question.

This year the following events will be taking place:

Venue	Max number	Dates available (time of session)
University of Birmingham	30	07, 28 Nov (1400 to 1630)
Edinburgh Napier University	40	07, 28 Nov (1230 to 1530)
Imperial College	20	07, 14, 21, 28 Nov (1230 to 1600)
University of Leeds	40	14, 21, 28 Nov, 05 Dec (1230 to 1600)
University of Loughborough	15	06, 08 Nov (1300 to 1530)
University of Manchester	25	07, 14, 21 Nov (1400 to 1600)
University of Oxford	20	14 Nov 1030 to 1500
Queen Mary, University of London	40	tbc
University of Sheffield	20	21, 28 Nov (1300 to 1500)

These events are free of charge for you and your students to attend; you just need to make your own arrangements to get to and from the venue.

Bookings are allocated on a first come first served basis so get in early to avoid disappointment!

To do this you can complete the enclosed form or download one from the website, www.iom3.org/AODP. Here you will also be able to get the most up-to-date list of dates and venues available.

THE ALL NEW SCHOOLS AFFILIATE SCHEME!

You may recall me mentioning in a previous issue that I have been busy writing reports and attending meetings to get a proposal to change the structure of the Schools Affiliate Scheme approved. After almost twelve months of discussion the new Scheme was finally given the go ahead at the Council meeting in March and will be launched in September.

Those of you that have met me will know how passionate I am about materials and spreading the word about my subject to as many people as possible. We wanted to develop a model that would allow the Scheme to be sustainable and expandable in the long term. One of the key aims was to make as many of the resources as possible available to as many people as possible, whilst also giving those who want extra interaction the opportunity to buy in additional resources.

The new Scheme has three membership options depending on the amount of interaction you want and how you would like to buy in additional support if you want it. The membership packages are as follows:

Standard Membership – Free of charge

Use your login details to access resources via the website (www.iom3.org/sas). These include the full back catalogue of support literature and all future resources, the full back catalogue and future issues of the newsletter, access to the full suite of Institute magazines and journals, presentations to use in schools and curriculum links, presentations and notes from our teachers' conferences, access to the list of willing speakers and network of local societies.

The number of standard members is not restricted and we hope that every member of staff in the science and D&T departments in a school will register.

If you wish to buy into additional resources you can do this, but it will incur a realistic, but reasonable charge. The charges have been set at a level that covers some of the cost of administering the delivery of the resources. These optional extras are available as follows:

- You can borrow a Discovery Box for a week for £40 (plus £200 refundable deposit),
- You can book me to come and talk to your students at a cost of £150 for one talk of up to an hour and a half or £200 for two talks of up to an hour and a half each,
- You can book a place on our annual conference for teachers for £50.

HOW WILL THE CHANGES AFFECT ME?

You should have received a letter with your newsletters outlining how these changes will affect you specifically, but this will mainly refer to the remainder of your membership for the 2011-2012 session.

All current SAS members will be transferred straight across to the Standard Membership option so you will no longer need to pay to receive all of the resources that you currently get.

We will be introducing an email update between the three newsletters so it is important that we have a reliable email address to contact you at. I would be really grateful if you would return the reply slip in with your letter providing us with this information.

In September you will receive a membership card giving your membership number and the details you will need to log in to the website.

If you do not want to continue with your membership or you would like to transfer to one of the other membership options please let us know.

We appreciate that some schools like to plan much further in advance so two other membership options are available:

Premier Membership

This membership option costs £150 per year and is limited to 30 members at any one time. The package is the same as Standard membership but also includes a Discovery Box for two consecutive weeks and one place on our annual conference for teachers.

Premier Plus Membership

This membership option is limited to 15 members and has an annual fee of £500. In addition to all the benefits of standard membership this also includes a Discovery Box for four consecutive weeks, a visit to give two talks and two places on our conference for teachers.

We hope that you will encourage your colleagues to sign up as Standard members too and a membership form will be available on the website very soon.

DISCOVERY BOX UPDATE

I know the launch of this resource seems to have been dragging on forever, but the boxes are almost ready! The delay has been due to trying to find a container to protect the boxes so that they don't get damaged in transit. You would not believe how difficult this has been but we finally seem to be close to a solution.

All of the information you will need to book a box will be going live on the SAS website over the summer. On these pages you will be able to see what is in the box, look at some of the information that comes with the box, find out what part of the curriculum it relates to and see the booking diary so you know when a box is available.

Once you have identified a date you will need to contact us so that we can send a booking contract out for you to sign. The £40 charge to borrow a box covers the cost of the courier to deliver and collect it from your school. However, there is also a £200 deposit which will be refunded on the safe and complete return of the box. This reflects the fact that the value of the contents is in the order of several thousands of pounds and many of the artefacts provided cannot be replaced. We will be doing a detailed check of each box before it is sent out and after it is returned to us to check that everything is as it should be.

If you would like more information please drop me a line diane.aston@iom3.org

A SPORTING PERFORMACE BY ADVANCED MATERIALS

A conference for teachers of science and design technology
Wednesday 04 July 2012. 1 Carlton House Terrace, London

Our conference for teachers this year will be on a sporting theme to tie in with the upcoming festivities, but rather than concentrating solely on materials used in sports equipment this conference has a broader brief and also considers the materials used in the sustainable construction of the Olympic venues.

The conference is running alongside four days of events linked to the World Lecture Competition and you will have the chance to hear from the finalists about why they chose materials.

The afternoon practical session will allow you to perform some simple tests on pieces of sports equipment that you could access back in school to demonstrate some of the key properties required.

The provisional programme is as follows:

0930 to 1000	Arrival and registration	
1000 to 1015	Welcome	Dr Diane Aston
1015 to 1030	New resources from IOM3	Dr Diane Aston
1030 to 1100	Higher, faster, stronger: Hero materials in sport	Jenni Tilley
1100 to 1130	Green roofing systems	Chris Hallas
1130 to 1200	Recycled plastics for kerb edging	John McLoughlin
1200 to 1230	The use of wood in sport	tbc
1230 to 1300	Why chose materials	WLC Finalists
1300 to 1400	Lunch and meet WLC finalists	
1400 to 1500	Practical activities : 'Citius Altus Fortius' & safer	Anne Martyn
1500 to 1530	Using the things you have learnt back in school	Dr Diane Aston / Anne Martyn
1545 to 1600	Refreshments, feedback and close	Dr Diane Aston

The conference is free to attend for any teacher from a SAS member school, for non-members there is a £50 delegate fee. There is no restriction on the number of attendees from one school.

If you would like to attend please complete the registration form enclosed with this newsletter (feel free to photocopy) or alternatively download one from the website by visiting www.iom3.org/events/sporting-performance-advanced-materials-0.

Planning ahead

I am already starting to think about our conference for teachers during the 2012-2013 academic year and would very much welcome your input.

The likely theme will be Materials in Medicine as artificial body parts always seem to capture the imagination of students on my visits and this is an area where materials are continuing to make an improvement to our quality of life. A number of universities now offer courses in biomaterials and this would be your chance to gather more information about these.

As yet the venue and date have not been set and this is where you come in. I would welcome your feedback on the best time of year to hold this event.

In future we might also look at putting the same event on at several regional venues to reduce the amount of travelling time involved in attending. Would this be something that would make coming along more appealing?

If you would like to contribute your views on these questions and suggest ideas for themes for other future events, please drop me a line to diane.aston@iom3.org

ROLLS ROYCE MATERIALS MASTER CLASS

The 2012 Rolls Royce Materials Master Class for secondary science and design technology teachers will be held on 10 and 11 July. The course aims to highlight the importance of materials in the context of aerospace applications and links into the KS4 and post-16 curriculum for science (chemistry and physics) and D&T (product design and resistant materials). Participants will be able to:

- Improve knowledge and understanding of materials technology
- Gain new ideas and identify contemporary contexts for teaching materials concepts
- Meet people persuing careers in materials and see how they apply their studies

Although the course is based in the Department of Metallurgy and Materials at the University of Birmingham the majority of the first day will be spent at Rolls Royce in Derby where participants will have the chance to see advanced materials science and engineering in action in the construction of jet engines. The second day, spent in the materials department, includes lectures and hands-on lab sessions to help you to improve your knowledge and understanding of materials. Activities include materials processing, mechanical testing and microscopy to show the importance of understanding the link between how a materials is made and its structure and properties. A session on hydrogen fuel cells is also included to help give you ideas of how to teach this area of the curriculum in a more engaging way.

The final session of the course is a discussion session where you and the other delegates will have the chance to develop ideas about how you can use the information you have gained back in the classroom.

The course is sponsored by Rolls Royce and the Worshipful Company of Armourers and Brasiers and is supported by the West Midlands Science Learning Centre, University of Birmingham and IOM3. The course includes overnight accommodation on 10 July, transport to and from Derby and all meals (including the conference dinner). There is a small course fee of £50 to cover the cost of administration.

For more information or to register visit www.slcs.ac.uk/westmidlands/11136. If you would like to check availability before you book please email enquiries@slcwm.keele.ac.uk or call 01782 734429.

POLYMER STUDY TOURS 2012

Just a quick reminder about the 2012 Polymer Study Tours! Although the dates are getting close there are still places left at all three centres for that last minute booking! The courses will be running as follows:

Edinburgh Napier University	17 to 20 June
London Metropolitan University	24 to 27 June
Manchester University	08 to 11 July

The four day residential courses are a unique blend of lectures, workshops, laboratory sessions and industry visits. They have been designed to improve your knowledge of polymers in terms of their structure, properties, processing and sustainability.

A typical programme includes:

Day 1 Starts Sunday afternoon to allow travel to the venue

- Introduction to the course and plastics industry
- Education support from the Institute of Materials Minerals and Mining
- Dinner followed by an informal ice-breaker event

Day 2

- Lectures on Polymer Materials and Applications
- Workshop in the labs including hands-on processing and testing
- Dinner with guest lecture from local industrialist or academic

Day 3

- Industrial visits to local plastics processing companies
- Course dinner with short speech by an Officer from the Worshipful Company of Horners

Day 4 Course closes by 1600 allowing for travel arrangements

- Practical on polymer identification and testing
- Lectures on History and Design of Polymer Products, Sustainable Environment, Polymer Industry and Support for Schools
- Final session – evaluation, development and improvement

The courses will be celebrating their 25th birthday in 2012, but if this does not demonstrate their worth enough, this is what previous delegates have to say:

"I now have a clearer more comprehensive understanding of the important role that plastics play in society"

"I had been concerned that the course might be aimed at chemistry teachers and although I might find it interesting it would not benefit my product design classes, how wrong could I have been!"

"Our day in the labs enabled us to get hands on contact with a variety of processes that we had little experience of"

The courses are fully sponsored by the Worshipful Company of Horners, the BPF and companies operating the polymer industry. However, in order to secure your place a £50 deposit is required, which will be returned with your attendance certificate following completion of the course. You can find out more about the courses and register using the enclosed leaflet or by visiting www.polymer-teaching-resources.co.uk or www.iom3.org.uk/sas. If you would like to check availability before you book please email diane.aston@iom3.org.

SCIENCE OF MATERIALS SUMMER SCHOOL

The Royal Society of Chemistry Summer School is moving to a new home this year and will be running at the University of Sheffield from 01 to 03 July 2012.

The Science of Materials Summer School is a 3-day residential course which gives chemistry teachers access to cutting edge materials science research which they can use in their teaching. Held in the Department of Materials Science and Engineering, the course gives teachers exclusive access to their laboratories and equipment, and offers them the chance to learn from researchers.

The course is made up of:

- Lectures and seminars providing information about the latest advances in materials science,
- Practical experiments which can be taken away and used in school. These simple experiments present existing material as materials science and also offer opportunities for extension material for the more able pupils,
- Discussions focusing on career opportunities in materials science.

The event is aimed at chemistry and science teachers who want to learn more about the latest advances in materials science and how these can be used in their day to day teaching. It links in with the KS4 and post-16 curriculum and has been designed to reinforce and challenge your existing knowledge.

The four broad themes of the course are Structure, Characterisation, Mechanical behaviour and Applications and within each theme there are lectures, demonstrations and hands-on activities. There is also the opportunity on each day to discuss how your new knowledge can be used back in school.

The course is organised by the Royal Society of Chemistry, sponsored by the Worshipful Company of Armourers and Brasiers and supported by the University of Sheffield and IOM3. The course fee of £125 includes all meals and refreshments (including the conference dinner at the Hall of the Cutlers of Hallamshire) and accommodation during the course.

For more information please visit http://www.rsc.org/ConferencesAndEvents/RSCEvents/Education/MatSumSch/

IOM3 AND PRIMARY SCHOOLS

Earlier this year we were successful in our bid for a grant to develop and pilot a resource to support the materials-related topics in primary schools. The funding from the Worshipful Company of Goldsmiths has come via the Tomorrow's Engineers initiative at the Engineering Council and we will be using some of the careers literature developed by Tomorrow's Engineers during the project.

We are aiming the project at year 6 and we would like to use it to support the KS2/KS3 transition. Ideally we would like our partner primary schools to work with the secondary schools that they feed into.

Our idea is to use STEM Ambassadors to deliver the project over two visits. The first visit, which will be the longer of the two, will be for a whole morning or afternoon and will be split into a number of activities designed to try and get the pupils thinking about science, engineering and materials, and why they are important to the world we live in. Activities may include some hands-on experiments and a materials treasure hunt to try and find unusual examples that have been hidden in their classroom. The first session will finish with an introduction to their challenge.

Over the following two to four weeks, the pupils will develop their ideas, write up their research and construct their designs using consumables left at the school before their STEM Ambassador will then return to judge the entries, test the designs and award the prizes.

The STEM Ambassadors that visit the schools will all be trained to deliver the sessions and they will be supplied with a handling collection containing lots of examples of different materials, a full kit for the experiments and all the consumables that the school will need to carry out the investigation. In addition there will be handouts, worksheets and notes for teachers to support the activity from start to finish. We want to try and make it as easy as possible for the schools to participate!

The pilot project will be running throughout the 2012-2013 academic year and our partner schools will be based in the London area (one of the stipulations of the Goldsmiths funding). However, once any teething issues have been sorted out, we will be launching the initiative across the UK.

If you are based in London and would like to take part with two of your feeder primary schools please get in touch, we would love to have you on board!

Dipping a toe in the water!

Earlier this year I visited a primary school to work with some year 3 pupils who were working through their materials topic.

This was a first for me and I thoroughly enjoyed working with the pupils, who were all too keen to share their experiences and ideas.

I went to school twice and the format of the visits took a similar form to the ones put forward in our grant proposal. During my first visit we talk about what scientists and engineers do and I got the usual answers of mending the car and fixing the boiler, before the kids really got the hang of engineers inventing and designing things.

It is really interesting to see that these long-standing stereotypes of what engineering is about are firmly planted in children's minds at a very young age.

Then we started to look at materials in more detail and I was very impressed at the knowledge the kids had of different types of materials and their useful properties. I had secreted a range of more unusual materials around the room and the kids had great fun finding and trying to identify them.

The kids thoroughly enjoyed the visit and I hope that the children and their teachers now have a much better appreciation of materials.

What is FANTASTIC PLASTIC?

Fantastic Plastic is a one hour demonstration lecture designed to link in to the KS4 curriculum for science.

Averil explains how the lecture progresses “After a brief overview of the great variety of physical properties of plastics that make them suitable for various intriguing and surprising applications, students are reminded of the basic concepts of solids, liquids and gases. From there, students are introduced to the idea of polymers consisting of long chain molecules. Polymers can exist as solid and liquids but often have properties of both (as in slime). Lively demonstrations show the effects of increasing the temperature, crosslinking the molecules, "tangling up" the polymer chains, and dissolving them in liquids. Some examples are given to show how by controlling what happens at the molecular level, the characteristics of the final material are determined.”

For audiences over 120 the lecture is free of charge. For more information visit http://www.scienceworks.org.uk/ or contact Averil at a.m.macdonald@reading.ac.uk

COURSES FOR STUDENTS

I am sure that you are all fully aware that we are now hitting peak season for taster courses for students. Many of your pupils may well be off experiencing science and engineering for themselves on excellent courses organised by the Smallpeice Trust, Headstart and others.

You might be starting to think of interesting excursions for you and your pupils in the autumn term. The Institute has around 60 local societies dotted around the UK and many of them are keen to support and promote materials by linking up with schools in their area.

Earlier this year the Materials Society of Cumbria organised for Professor Averil MacDonald to give her ‘Fantastic Plastic’ lecture to around 700 students. Later this year Averil will be giving her lecture again for two other local societies.

Following the huge success of their events over the last couple of years the Scottish Plastics and Rubber Group (SPRA) will once again be hosting Averil at the start of the new academic year. This year their event will be bigger and better than ever, with three lectures in three different cities. The first lecture will be held at Dundee University on Monday 03 September, the second in Glasgow (venue tbc) on Tuesday 04 September and the final lecture on Wednesday 05 September at Edinburgh Napier University. For more information or to book places, contact Colin Hindle at c.hindle@napier.ac.uk.

On Tuesday 02 October the West of England Metals and Materials Association (WEMMA) will be putting on their first schools lecture and they have chosen a great opener! The lecture will be taking place in the main lecture theatre at Kingswood School in Bath and the planned start time is 1830hrs. Drinks and snacks will be provided for all after the event and attendees will have the chance to speak with local engineers. The lecture is aimed at students studying A-levels in Physics, Chemistry and /or Design Technology and numbers are limited to 325. If you would like to find out more or book places contact Laurence Wilshere at Laurence.wilshere@gmail.com.

In both cases, places will be allocated on a first come, first served basis.

YTTRIUM

- Yttrium has atomic number 39 and atomic mass 88.90. It is a second transition series metal and sits in Group 3 (IIIB) of the Periodic Table between strontium and zirconium and with scandium above and lanthanum below.
- Yttrium melts at 1526°C, boils at 3336°C and has a density of 4.472gcm^{-3}.
- At room temperature yttrium is a soft, silvery metallic material with a hexagonal crystal structure. It is lustrous and highly crystalline. It is relatively stable in air due to the formation of a passive oxide layer.
- The chemical properties of yttrium are similar to those of the lanthanides and it is often characterised as a rare earth element.
- For many years the chemical symbol of yttrium was Yt; the symbol Y, that we use now, has been used since the 1920s.
- The discovery and isolation of yttrium took many years. A heavy black rock containing an unknown mineral was collected by Carl Axel Arrhenius in 1787 in a quarry near the Swedish town of Ytterby. Between 1794 and 1797 a number of chemists investigated the rock and named the new oxide that they had found 'yttria'.
- The metal was first isolated in 1828 by Friedrich Wöhler who heated anhydrous yttrium chloride with potassium.
- It is the 28th most abundant element in the Earth's crust at a concentration of about 31parts per million.
- Yttrium never occurs as a free element; it occurs in most rare earth minerals and some uranium ores.
- Commercially, yttrium is separated from the other elements following concentration of one of the main rare earth element sources. The ore preparation process is complex and is followed by another multistage process to extract the yttrium metal
- The estimated world reserve of yttrium is 9 million tonnes with annual production at the level of a few hundred tonnes.
- One of the main applications of yttrium was in the manufacture of red phosphors for cathode ray tube television sets. Yttrium is also used in LEDs for more modern TV screens.
- Yttrium compounds are used in a number of interesting applications such as the production of synthetic garnets (YIG and YAG; yttrium iron garnet and yttrium aluminium garnet), solid electrolytes in the form of yttrium-stabilised zirconia and as the first superconductor to operate at liquid nitrogen temperature as yttrium-barium-copper-oxide (YBCO). They may also be used as catalysts for polymerisation reactions.

Yttrium is a highly crystalline metallic element.
http://en.wikipedia.org/wiki/File:Yttrium_sublimed_dendritic_and_1cm3_cube.jpg

Xenotime is rare earth phosphate whose main constituent is YPO_4.
http://en.wikipedia.org/wiki/File:Xenot%C3%ADmio1.jpeg

Magnet levitating above a high temperature YBCO superconductor.
http://en.wikipedia.org/wiki/File:Meissner_effect_p1390048.jpg

Where can I find out more?

http://en.wikipedia.org/wiki/Yttrium
http://en.wikipedia.org/wiki/Yttrium_aluminium_garnet
http://en.wikipedia.org/wiki/Yttrium_barium_copper_oxide
http://en.wikipedia.org/wiki/Yttria-stabilized_zirconia

Who is Mark Miodownik?

You may remember Mark from a couple of years ago when he presented the RI Christmas Lectures in 2010. The series of three lectures, entitled Size Matters are now available to view online by visiting www.rigb.org and then searching for Christmas Lectures 2010.

Mark is an engineer and materials scientist. He is based at the Institute of Making at UCL and is one of the founders of the Materials Library, a collection of unusual and exciting materials. You can find out more about Mark and his endeavours at www.instituteofmaking.org.uk

HANDS FREE AND HANDS OFF!

On 15 June 2012 the Royal Society of Chemistry is hosting a free workshop for sixth form chemistry students at Bromsgrove School. Activities start at 1000 and finish at 1530 and include:

- Workshops on the chemistry of your phone
- Tips from a Uni Admissions Tutor
- Chance to meet scientists from universities and industry
- Advice on university courses and careers
- Free CPD session for accompanying teachers

For more information or to book places for you and your students contact Heidi Dobbs at heidi.dobbs@nottingham.ac.uk

MATERIALS IN THE MEDIA

Did any of you catch the excellent three part series on BBC Four presented by Mark Miodownik? The three programmes explored the three main groups of materials, metals, polymers and ceramics, through the ages and looked a how materials scientists are developing new materials with amazing properties. The programmes were repeated on BBC2 in early May.

The BBC has made a number of clips from the programmes available on their Learning Zone website; go to www.bbc.co.uk/leraningzone/clips/ and then search for materialshowtheywork (no spaces). The clips vary in duration from around two to eight minutes and can be streamed directly from the web.

Clips on the following topics are available:

Metals	Polymers	Ceramics
Bronze – the first alloy	The plastic revolution	The Romans invent concrete
Superalloys and the jet engine	Bakelite – structure and properties	The invention of reinforced concrete
Obtaining copper from its ore	History and uses of carbon fibre	How reinforced concrete works
The structure of metals	Discovery and uses of graphene	Why concrete is brittle
	Structure and uses of vulcanised rubber	The discovery of superconductivity
		Superconductivity and the Meissner Effect

FREE STEM ACTIVITY DAYS IN YOUR SCHOOL OR COLLEGE

The Faraday Challenge Days are one day activities, designed for six teams of six students aged 12-13 years, delivered in your school by the IET. They give students the opportunity to research, design and build prototype solutions to genuinely tough engineering problems.

There will be 45 in-school Faraday Challenge Days taking place this season, starting in September 2012, with the winners of each event winning prizes for themselves and their school. The top three teams from across the UK get an all expenses paid trip to the National Final in June 2013 to compete for a **cash prize of up to £1000** for their school.

Each host school needs a school hall or large classroom for the day, and six teams of six students to take part (36 students in total). The school can either enter all six teams from their own school, or enter one team from their own school, and invite five teams from local schools to join them.

Go to http://faraday.theiet.org/stem-activity-days/ to download the 'Host school application form' or for further information.

SUPPORT FOR SCHOOLS FROM THE WORSHIPFUL COMPANY OF ARMOURERS AND BRASIERS

The Company is keen to encourage and support materials-related teaching at school level. The following activities will be sponsored in 2012. Full details are published in the leaflet '*Resources for Materials Teaching in Schools'* which is available from the Company's website: www.armourersandbrasiers.co.uk

Master Classes in Materials Science/Engineering:

Residential courses for teachers of physics, chemistry, technology and general science at pre- and post-16 levels to introduce the academic and industrial aspects of materials. They consist of lectures, laboratory work and seminars at Birmingham University with a works visit to Rolls-Royce plc at Derby. The next Master Class and associated works visit will be held at Birmingham and Derby (10 and 11 July 2012). See article on page 6.

Teachers' conferences on materials topics:

One-day conferences on aspects of materials in the national curriculum that are often challenging to teach. The next conference entitled 'A sporting performance by advanced materials' will be on 04 July 2012. See article on page 5.

Summer schools on 'the science of materials'

These annual residential Summer Schools are designed to introduce materials science to teachers of chemistry at pre- and post-16 levels. This year the course will be held in the School of Materials at the University of Sheffield for the first time and it will be running from 01 to 03 July 2012. See article on page 8.

Updates for physics teachers

The Institute of Physics runs three update courses each year. Each course includes a lecture, often accompanied by a demonstration or practical activity, to introduce teachers to materials science. The Summer Update for 2012 will be at the University of Birmingham (06 to 08July) and the date and venue for the Autumn Update is still to be confirmed. Contact: Manchi Chung: 020 7470 4820 (Manchi.chung@iop.org)

Headstart Courses in Materials:

Residential courses for 17 year-olds on materials science at *Oxford University*. Contact: Diane Taylor 01865 273709 (diane.taylor@materials.ox.ac.uk)

Materials Science in Salters' Chemistry Camps

Materials science talks and practical activities in these well-established residential Camps run by the Salters' Institute for 15 year-olds at *Heriot-Watt, Manchester* and *York Universities*. Contact: Stephanie Amos 0207 628 5962 (camps@salters.co.uk)

Equipment Grants for Schools

Grants for science equipment and projects up to £600 for primary schools and to £1000 for secondary. Contact: The Clerk, Armourers' Hall 020 7374 4000 (clerk@armourersandbrasiers.co.uk)

Who are they?

The Worshipful Company of Armourers and Brasiers' is one of the original livery companies of the City of London.

The Guild of St George of the Armourers was instituted in 1322 to lay down regulations for the control of the trade and its first Royal Charter was granted by King Henry VI in 1453.

The Company's current charter was granted by Queen Anne in 1708 to give the Brasiers (workers in brass) equal status within the Company, though they had been working with the Armourers since the 16th century.

The majority of the Company's charitable giving is now directed to supporting materials science and engineering. Through the Gauntlet Trust the Company provides support for all stages of education from primary schools to courses for secondary teachers, scholarships for UG students, travel bursaries for postgrads and the Venture Prize for materials science research.

For more information visit www.armourersandbrasiers.co.uk

Mark Rogers, a D&T teacher from King Edward VI School in Lichfield, writes about the exciting project that they are undertaking to raise awareness of Materials Science and Engineering amongst students studying A-levels in STEM subjects.

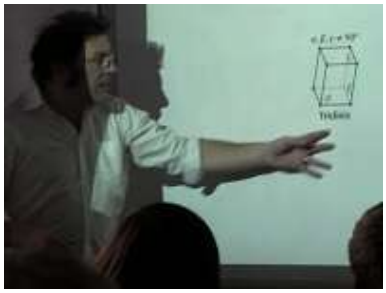
EMPOWERING A-LEVEL STEM STUDENTS TO CHOSE MATERIALS SCIENCE AT UNIVERSITY

Rolls Royce Science Prize 2012 Finalists

For years at King Edward VI School, Lichfield we have been seeking a truly meaningful 'Science & Technology' dimension to enrich our curriculum so that we can exploit the potential of cross-fertilization between our Science and Design & Technology departments. Over the years we have been involved in many well-meaning initiatives that eventually ran out of steam or were one-off experiences that lacked depth and longevity.

In July 2010 a Physicist colleague and I attended the Rolls Royce Materials Master Class. This involved two days of activities in the Materials Department at the University of Birmingham and a one day visit to the Rolls-Royce plant at Derby. The experience was truly inspiring and we realised that we had found just what we were looking for. It became obviously apparent to us that Materials Science has enough depth and breadth for the study of 'real' science, and through exploring related applications of materials, enough scope for design students to be able to explore the powerful potential of new materials and technologies.

We believe that we have found a niche in the education and development of young people in the process of transition between school and university. We decided to put forward an entry for the Rolls-Royce Science Prize which is intended to promote exciting and high quality teaching and learning of science in secondary schools and have been successful in being shortlisted for the 2012 Prize. Whether we win or not, it is fully our intention to carry on this work and go beyond the remit of the competition.



The Project

When it comes to the transition stage from school to university there is relatively little to assist students in what surely is as significant a process of change as any they will have faced previously. Possibly the most important decision a STEM student makes is which course to undertake subsequent to their time at school. This and the uncertainty of the transition process often leads students to fall back on the 'comfortable' option of what they are familiar with based upon their experience of science education at secondary school level. Thus, many students focus on the mainstream sciences, such as Chemistry, Physics and Biology. This means that other discrete but nevertheless vitally important subject areas like Materials Science are often overlooked.

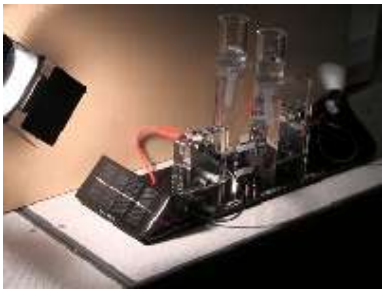
Between 2008 and 2010, 91 of the 401 students that left King Edward VI School, Lichfield went on to follow a STEM-based subject, but only one of these chose to study materials. The vision for our Rolls-Royce Science Prize project is to make our students more aware of Materials Science courses so that they are able to make better informed decisions. We strongly believe that if this is the case the number of students opting onto such courses will increase.

We aim to establish a series of materials science learning experiences which are embedded into our sixth form calendar on an annual basis and synchronised with the UCAS application process. This year our year 12 physics and D&T students visited the Materials Department at the University of Birmingham as part of the Autumn Open Day Programme (administered by IOM3) to get some hands-on experience of working with a variety of materials. Diane Aston from IOM3 has visited to talk to our students and staff at the University are providing e-mentoring. We have also tried to make links with local companies working in materials to see if they can offer visits or speakers. Each student is producing a folder of experiences to record instances where they have encountered materials, whether that is a university visit, an article on a website, a visiting speaker or correspondence with their e-mentor. We feel that it is important to show our students the broad range of options that studying materials can offer. We see this as a long term venture, planned and executed in such a way to bring obvious benefits of widening access to university courses for our students. We realise that whatever we plan must be sustainable in terms of staffing, time and resources. We wish to avoid a 'short term fix' approach which we believe would have little chance of delivering the results we are looking for. Really importantly, we also see opportunities to take students outside the constraints of the A-level specifications we follow at our school. This will benefit all students who participate even if they do not proceed onto a materials science course. At the very least they will all enhance their understanding of this discipline within STEM topics.

The team at King Edwards' has worked very hard to make the project a success but we owe a great deal of thanks to Professor Claire Davis and Edwina Cooke from the Materials Department at the University of Birmingham for their help and support.

Once we have established this project in our school, which we appreciate may take a number of years, we would like to share our experiences and perhaps encourage other schools to undertake something similar with their STEM students.

During their recent visit to the Materials Department at the University of Birmingham our students explored the potential of hydrogen fuel cells and had a go at making loudspeakers



OXYGEN

- Oxygen has atomic number 8 and atomic mass 15.999. It is one of the chalcogens elements and sits in Group 16 (VIA) of the Periodic Table between nitrogen and fluorine and above sulphur.
- Oxygen melts at -218.79°C and boils at -182.95°C and has a density of 1.429g.l at 0°C.
- Oxygen is an odourless, tasteless diatomic gas at room temperature. It is often thought to be colourless; however it does have a slight pale blue colouration.
- The electronegativity of oxygen is second only to that of fluorine so it is a very strong oxidising agent. Most elements react with oxygen to create oxides.
- Oxygen is the third most abundant element in the Universe by mass and when measured this way it is the most abundant element in the Earth's crust, accounting for about half of its mass. It is the most abundant element in sea water and the second most abundant element in the atmosphere.
- The name oxygen was given by Antoine Lavoisier in 1777 however, it had been independently discovered by Carl Wilhelm Scheele in 1773 and Joseph Priestly in 1774.
- 100 million tonnes of oxygen are extracted from air each year for industrial applications. Commercially, oxygen is produced by two very different techniques. Fractional distillation of air is the most common method but pressure swing adsortption is becoming increasingly popular as it does not involve cryogenics. Bulk transportation of oxygen is usually done in its liquid form, but where small quantities are required cylinders of compressed gas are available.
- Oxygen is fundamental to our very being. It is the main constituent of the water in plants and animals and it is a key element in respiration and photosynthesis.
- Many of the applications of oxygen relate to its biological importance; however it is an industrially valuable material too.
- 55% of the commercially produced oxygen is used in the Basic Oxygen Steelmaking process where it is blown through iron from the blast furnace to reduce its carbon content and make steel. It is also used in metal cutting and welding as the addition of O_2 can produce a very hot flame.
- Ethelyne glycol, an important precursor in the manufacture of polyesters and polyethylene glycol (anitfreeze), is made by reacting ethylene with oxygen.
- Oxygen is also used as the oxidising agent for the fuel in large rockets.
- Many compounds of oxygen also play a crucial role in our society. Noteable amongst these are suphates, carbonates, phosphates, oxide minerals such as silica and alumina and oxygen-containing organic compounds.

Pale blue liquid oxygen with oxygen bubbles rising through it. http://en.wikipedia.org/wiki/File:Liquid_Oxygen.gif

The trees in the rainforests release oxygen into the atmosphere as a by-product of photosynthesis. http://upload.wikimedia.org/wikipedia/commons/6/65/Rainforrest_between_Kuranda_and_Cairns%2C_North_East_Queensland.jpg

Where can i find out more?

http://chemistry.about.com/od/elementfacts/a/oxygen.htm
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