schools affiliate scheme

CONNECTING TEACHERS TO THE WORLD OF MATERIALS, MINERALS AND MINING

news

Issue 37

Spring term 2011

In this issue:

A NEW TERM AND A NEW RESOURCE

Hello there, hope you had a good Christmas break and are back in to the swing of things.

Firstly, I must apologise for the slight delay in the publication of this newsletter. Over the past couple of months I have been very busy writing the new SAS website and am pleased to tell you that it is now live. You can find out more about the current content of the site and how I plan to grow it on page 4.

Also in this issue you can find out more about the launch of the DigIT! to BuildIT! Competition and the Starpack Awards which are both running at the moment.

This is the time of year when a number of organisations are running courses for teachers and we are involved in supporting a number of these. You can find out about the Polymer Study Tours on page 3 and a selection of other events on page 15.

The centre page article in this issue looks at recycling and on page 12 you can find the second instalment of your Ultimate Guide to Ceramics.

As usual if I can be of any assistance to you please get in touch!

This newsletter is written and edited by Dr Diane Aston, Education Co-ordinator.
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 Centre, The Boilerhouse, Springfield Business Park, Caunt Road, Grantham, Lincolnshire, NG31 7FZ.

The Institute of Materials, Minerals and Mining

THE NEXT BIG THING...

As I am sure you are aware, next year will be a big year for UK plc as the Olympics and Paralympics role into town.

It will be a big year for the Institute too as our biennial conference will also be taking place.

This amazing coincidence has given us an opportunity that is just too good to waste so Congress 2012 will be themed around materials in sport. The two day conference will feature invited speakers talking about everything from materials in sports equipment to sustainable building materials for the Olympic venues.

We are planning to host a special event for teachers on the second day of the conference which will start with a tour around an Olympic site on the previous evening.

The exact date and venue will be finalised in the next few weeks so watch this space for details in the summer newsletter!

A FANTASTIC OPPORTUNITY FOR STEM STAFF TO ATTEND THIS DEFINITIVE STEM CAREERS AWARENESS EXPERIENCE.

Students who study STEM subjects acquire analytical and problem solving abilities that are highly attractive to potential employers. Therefore it is important to highlight to young people the career opportunities available to them from studying STEM subjects further.

'**Promoting STEM Careers in your Classroom'**, a two day conference delivered by the National Science Learning Centre, York, will help you by providing a wealth of resources and information to raise awareness about the exciting STEM related careers available to your learners.

This conference is ideal for careers advisers and teachers of STEM subjects from KS3 through to Post-16. The event will highlight resources and opportunities to promote careers in the curriculum. There is opportunity to network with schools who have successfully integrated STEM careers awareness into their curriculum, as well as to major stakeholders, including the Department for Education's STEM Cohesion Team and network with national and regional STEM organisations.

Promoting STEM Careers in your Classroom
Date: 17 – 18 March 2011
Course Cost: £351 +VAT
ENTHUSE Award: £751.00

To book your place on this exciting conference, please phone 01904 328 300 and quote nac10114p or visit www.slcs.ac.uk/national/nac10114p

*This conference carries an **ENTHUSE Award** of £751, an easy to apply for bursary available to all teachers, tutors and lecturers from maintained schools or colleges to help cover costs plus a small amount of money to help implement ideas once back in the classroom.*

For further information about the ENTHUSE Award, please visit www.slcs.ac.uk/enthuseaward

POLYMER STUDY TOURS 2011

Would you like the opportunity to find out everything you ever wanted or needed to know about polymers?

If your answer to this is yes then you need to go on a Polymer Study Tour! These four day residential courses have been running since 1987 and are FREE to attend; you just need to send in a £50 deposit cheque which will be refunded when you attend the course.

The courses are designed to deepen and broaden your knowledge of all things polymer related and include a mix of lectures, lab workshops and industry visits. They provide valuable teaching resources which link in to the science and technology curriculum.

The dates and venues

12 to 15 June	Edinburgh Napier University
19 to 22 June	London Metropolitan University
10 to 13 July	Manchester University

Typical programme

Day 1 Arrive at venue of Sunday afternoon

Introduction to the course and the plastics industry
Dinner followed by an informal ice breaker event

Day 2

Polymer materials and polymer applications – formal lectures and hands-on workshops in the labs.
Dinner followed by guest lecture from local industrialist or academic

Day 3

Industrial visits to local plastics processing companies.
Course dinner with a short speech by an Officer from the Horners' Company.

Day 4 Course finishes by 1600 to allow for travelling home

Polymer identification and testing.
History and design of polymer products.
Presentation and discussion on the sustainable environment.

How to apply

You will find an information leaflet and application form enclosed with this newsletter but for more information you can visit www.polymer-teaching-resources.com or email diane.aston@iom3.org

The Horners' Company

What previous delegates say:

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

"I had been concerned that the course might be aimed solely 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 or no experience of. Indeed it helped us to gain a better understanding of the processes involved in the factory tours on day 3"

"The blend of science and technology teachers has given me a greater understanding of the parts of the curriculum common to both courses."

2010-2011 SAS RESOURCE

Following the success of the nanotechnology conference in October we have decided to make a slight change to the SAS resources for the next couple of years.

The new resource for schools joining or renewing their membership this academic year will be on nanotechnology. The book will feature chapters on the history of nanotechnology, current and future applications and processing materials on the nanoscale.

I am writing this at the moment and it should be ready to distribute after the Easter holidays.

The resource for 2011-2012 will be on a sporting theme to tie in with the teachers' event at Congress 2012.

Before the Christmas break you should have received your copy of the SAS resource for the last academic year on Bridges. I hope that you have found this collection of information cards and poster useful and if you would like extra copies you can download them from the website

NEW SAS MICROSITE

I am really pleased to announce that the new Schools Affiliate Scheme website has recently been launched!

This is something that I have wanted to write for a long time and deciding on its structure and content has been a very time consuming job.

At the moment I have only managed to upload back copies of the newsletter, element focus and support literature but in future you will also be able to download presentations, find out more about the resource boxes and the willing speakers list. There will also be an events section with information about past and present conferences that we have run for teachers (including presentations for you to download and use) and relevant events run by other organisations.

A couple of weeks ago I wrote to you with your username and password for the website and I hope that you have had a chance to have a look around and that you have found the content to date useful. We are currently in the process of producing plastic membership cards for all members so you can keep all your important information (membership number, renewal month, username and password) in once safe place. You should receive your card in the coming weeks.

If you have any suggestions for new content please let me know and do keep checking back to see what's new!

CAN YOU BUILD THE ULTIMATE BRIDGE?

You may remember that last year we ran a competition for schools to design the ultimate bridge using wood and wood based products.

On 24 June 2010 the seven shortlisted teams from four schools attended the final here at The Boilerhouse in Grantham.

The day started with an introduction to wood and the timber industry and the students were shown some amazing examples of products made from wood, including a working car! They then had the chance to build a full size wooden bridge capable of supporting a whole team and a self supporting wooden floor made from short pieces of wood.

Over lunch the students had chance to look at the posters submitted by the teams giving details of the materials and ideas used in their bridge designs.

After lunch it was time for the main event of the day – testing the bridges! Before the testing got under way each team gave a short presentation to tell the group about their design and how they had made their bridge. The students all did extremely well at putting their ideas across despite some nerves! Once the theory had been explained it was time to move on to more practical matters and see how much the weight the bridges could support.

Very early on it became apparent that Barry and Gervais, the designers of the test rig, had underestimated just how good the bridges were going to be as they all refused to break and many did not deflect much either. After a hasty discussion it was decided that the lightest bridge which could support the heaviest weight with the least deflection would be the winner and on this basis the team from Newland House School in Twickenham came out on top. The team comprising of Thomas, Arthur, Archie and Nicholas said that they had really enjoyed learning about materials and coming up with the design for their bridge.

A team of girls from St Paul's School in London won the prize for the best poster.

Thank you to all the schools that took part in the competition and to the Wood Technology Society, particularly Barry Matthews and Gervais Sawyer for their help.

Barry Matthews and Gervais Sawyer from the Wood Technology Society talk to the teams about wood and wood based products.

The shortlisted teams help to build a self-supporting wooden floor and a wooden bridge.

The Newland House Team with their winning bridge design, their bridge under test and receiving their prizes.

DIGIT! TO BUILDIT! IS A HIT AT BRETBY

Jackie Butterfield, from IOM3 writes about the launch of DigIT! to BuildIT! at the recent Ceramics Society Conference.

To find out more about how to get involved with DigIT! to BuildIT! please contact Jo Chapman at jo.chapman@proskills.co.uk.

About DigIT! To BuildIT!

The DigIT! To BuildIT! scheme is a major industry-backed programme designed to teach young people about the exciting world of Extractives and Building Products industries and to encourage learners to consider a career path related to the UK process and manufacturing industries.

DigIT! to BuildIT! is for Year 9 Geography students, GCSE Science & A level Geology students and students studying the Diploma in Construction & the Built Environment.

Following the success of PrintIT! Proskills, the Sector Skills Council for the process and manufacturing sector, has launched another four 'Schools into Industry Programmes' (SIIP). DigIT! to BuildIT! was launched at Bretby 2010 – Building a Greener Future, at the Bretby Conference Centre with the aim to attract young people into the exciting industries of Extractives, and Building Products.

Local schools, companies and industry leaders attended the event that introduced Proskills newest SIIP, giving local employers the chance to meet with teachers and students who they could potentially partner up with during the DigIT! to BuildIT! programme.

Proskills Schools Programmes manager Jo Chapman explained the importance of businesses engaging with their local schools, *"DigIT! to BuildIT! is all about showing how interesting and exciting the Extractives and Building Products industries are, that's why it is so important for students to get a real understanding of this by twinning with local businesses and seeing for themselves how they work. It is a golden opportunity for employers to build relationships with local schools and to attract younger generations into their workforce and industry."*

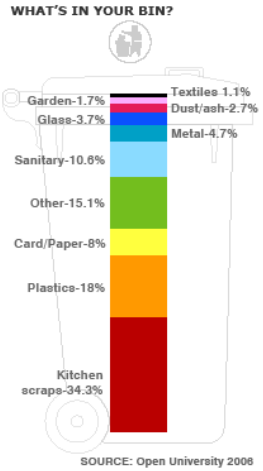
A class of students from Murray Park School, who are taking part in DigIT! to BuildIT! attended the launch. Teacher Alex Foreman explained, *"I think DigIT! to BuildIT! will be a real benefit to students because of its wide ranging construction links, we are really looking forward to getting started on the programme and seeing what it has to offer."*

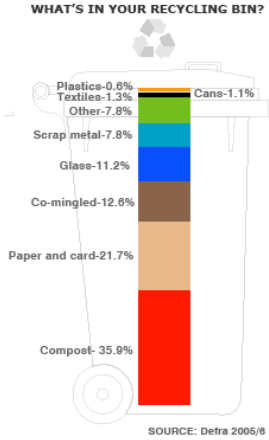
Lauren Shaw, who is studying for a Diploma in Construction and the Built Environment at Murray Park School said, *"We really enjoyed the launch of DigIT! to BuildIT! and found that we gained a lot out of it. The part which I found the best was the teamwork activity at the end as we learnt the skills needed to work to a specific deadline. I think the programme will be really good because we will get to visit companies and see how they work."*

Chris Hallas, Director of Shire Minerals commented on how the SIIP could benefit the Extractives and Building Products industries, *"DigIT! to BuildIT! is an ideal opportunity for building materials companies to increase their visibility with schools and young people to make them aware of this exciting industry. Hopefully by taking part in DigIT! to BuildIT! and finding out what the industry has to offer, these young people will look to the building products sector as a future career choice."*

RECYCLING

Every year as a nation we throw away 29 million tonnes of household waste and the amount of waste we generate has gone up by 16% since 1991 to around 495 kilograms for each individual in the UK! In recent years many Local Councils have tried to emphasise the importance of recycling and set up individual collections for the different material types. In addition recycling stations have been available for many years at locations such as supermarket car parks. In the near future the amount of recycling we do as individuals will have to increase as European Directives come into place, which stipulate minimum amounts of waste Local Councils must recycle, by 2020 this figure will be about 50%. At present we only recycle around 35% of our waste and this varies from region to region.





A wide variety of different materials are used in packaging household products, including metals, paper, glass and a number of different polymers. Each of these materials has its own special properties for the particular application. But most of us simply discard these materials after use and they end up in landfill or an incinerator. Burning rubbish which cannot be reused in other ways is now being used in several European countries to generate energy which heats water for towns and cities. Emissions from the incinerator chimney must be carefully controlled to ensure that these are not harming the environment.

Recycling metals

Most domestic metallic packaging is made from either steel or aluminium which are easy to separate because of the magnetic nature of steel and both of which can easily be recycled.

Each household uses around 600 steel cans each year and a quarter of each can is made from recycled material. Huge electromagnets are used to separate steel from other materials on a commercial level.

Recycled steel can be added to the Basic Oxygen Steelmaking furnace to reduce the amount of new material needed and scrap metal usually accounts for about a quarter of the content. In some cases the BOS furnace contains almost 100% recycled steel. Scrap steel can also be turned into new material in an Electric Arc Furnace

which uses electrical energy to melt the scrap steel. Recycling just one tonne of steel saves 1.5 tonnes of iron ore and 0.5 tonnes of coke, both of which will reduce the impact of quarrying on the environment. It also saves 1.28 tonnes of solid waste, reduces air emissions by 86% and reduces water pollution by 76%. Recycling steel saves up to 74% of the energy needed to produce steel from its raw materials. If all the drinks cans in the UK were made from recycled steel the energy saved would be able to light every home in the UK for several weeks!

Aluminium is the most abundant metallic element in the Earth's crust and is the second most commonly used metal. Globally 24 million tonnes of aluminium are produced annually. In the UK we use around 1 million tonnes, 20% of which are used for packaging. The remainder is used in engineering, transport and building applications. Over 90% of the aluminium produced for packaging is used for domestic products such as cans, ready meal boxes, foil bottle tops and chocolate wrappers. Over 5 billion cans are sold every year in the UK, this is equivalent to 200 cans each.

Producing aluminium from its raw materials is incredibly energy intensive as electrolysis is required. Recycling aluminium requires only about 5% of the energy used to make the primary product. This means that 20 recycled cans could be produced with the same amount of energy as is needed to make one from scratch!

Shredded aluminium cans. From http://upload.wikimedia.org/wikipedia/commons/9/97/Shredded_aluminium_cans.png

In order to recycle aluminium scrap is first collected and checked to make sure that it does not contain any contaminants as these could disrupt the recycling process. The waste is shredded in to small pieces with a diameter of around 2cm and any coating is then removed by blowing hot air through the shreds. The clean aluminium shreds are melted and cast in to ingots weighing 27 tonnes. Each ingot contains enough aluminium to make 1.6 million new cans. The ingots are reheated and rolled. Cold rolling is used to roll the aluminium into sheet meeting the exact specification of the manufacturer and this is then made in to cups using a deep drawing process. After coating and printing the cans are cleaned and filled before the lid is attached and the new product delivered.

Aluminium may be recycled many times without degrading its properties and even over only a small number of cycles

this can save a phenomenal amount of energy. Recycling one tonne of aluminium saves 8000 tonnes of bauxite ore and 4000 tonnes of chemical bi-product. Simply recycling one can saves enough energy to run a television for 3 hours!

Recycling plastic

Plastic waste accounts for almost half a million tonnes of material each year. The majority of this plastic waste ends up in landfill sites where it occupies a large amount of space (plastic bottles are bulky items) and takes many years to degrade, depending on the conditions. Almost all the plastic we use today in packaging originates from oil, our supplies of which will run out in the not too distant future. It is therefore very important that we make the maximum use of the polymers we have, by reusing and recycling them, and look to developing new plastics made from renewable sources that are environmentally friendly. Recycling plastics also saves energy, in fact recycling just one plastic bottle saves enough energy to power a 60W light bulb for almost 6 hours!

Before plastics can be recycled they must be sorted, as each different type has a different composition and mixing plastics generally has a detrimental effect on their properties. Plastic containers now usually carry a symbol to allow their identification to be much simpler, these are shown left. However, there are a few useful guidelines:

Fizzy drinks bottles are usually made from PET (polyethylene teraphthalate) as this material can cope with the pressure associated with a carbonated product. These bottles are produced by injection blow-moulding and this process leaves a characteristic mark in the centre of the base. PET is also used for non-carbonated drinks as it is very light.

High density polyethylene (HDPE) is used to contain liquids such as milk, juice and laundry detergent. This material is not strong enough to cope with the pressure of a carbonated drink. These bottles are made in two halves which are then joined together, leaving a tell-tale seam.

Yoghurt pots are generally made from polystyrene and will return to their original disc shape when warmed in an oven.

Recycling symbols for different polymers. From top to bottom polyethylene teraphthalate, high density polyethylene, polyvinyl chloride, low density polyethylene, polypropylene, polystyrene and others.

Where can I find out more?

Many companies are very keen to support the teaching of recycling and sustainable living and product design in schools and a number of resources and websites have been produced:
www.recyclezone.org.uk
www.wastewatch.org.uk
http://www.reducereuserecycle.co.uk/
http://www.recyclenow.com/schools/secondary_school_resources/
http://www.recycling-guide.org.uk/schools.html
www.scrib.org – steel can recycling information bureau

The web also has a wealth of information on recycled products:
www.smile-plastics.co.uk
www.whyusewood.com
http://www.britishrecycledproducts.co.uk/
http://www.recycledproductsonline.co.uk/

You can also have a go at making your own recycled material by ironing carrier bags together between two sheets of greaseproof paper!

I have 20 copies of a CD Rom on recycling steel from SCRIB to give away! For your chance to get a copy please send an email with SCRIB CD ROM in the subject line and your correspondence address in the main message to diane.aston@iom3.org

Recycled plastic can be used to manufacture a wide variety of new products from lower grade containers to clothing. An adult size fleece jacket can be produced from 25 recycled PET bottles. There is a high demand from reprocessing companies for plastic waste and in 2002 330,608 tonnes of plastic packaging waste was recycled. This is equivalent to 360 million plastic bottles; but this is only 3% of the bottles thrown away.

Recycling glass

Glass has been used as a packaging material for hundreds of years and it is still commonly used today. When we think of recycling materials, glass comes quickly to mind as we are all familiar with the recycling banks for clear, green and brown glass. Recycling glass saves on raw materials, but also saves energy.

The raw materials for making glass are sand, limestone, soda ash and most importantly recycled glass or cullet. These are gathered and melted together. A typical furnace can run continuously and produce around 300 tonnes of glass each day. The new molten glass is formed in to new bottles or jars. In 2003 1.8 million tonnes of glass were produced by UK manufacturers and a third of this was made from recycled material.

Over three quarters of the glass produced in the UK ends up in our homes. We as consumers then have to decide whether to recycle that glass or put it in the bin where the useful resources will be buried. We currently waste 1.4 million tonnes of glass by sending it to landfill.

In the UK there are over 50,000 bottle banks, but glass is also collected from commercial users such as pubs. Brown, green and clear glass containers are collected separately to maintain the colour of the final product. Any contaminants such as metal, paper and plastic are removed.

The recycled glass is mixed with raw materials and the process starts again. This cycle can be repeated an infinite number of times without degrading the final product.

Recycling glass saves a huge amount of energy; recycling one tonne of glass saves 345kWh of energy. Recycling that one tonne of material will also save the emission of 225kg of carbon dioxide, save quarrying 1.2 tonnes of raw materials and save one tonne of material from going in to landfill.

COURSE ROUND-UP

It is that time of year again when everyone is starting to look at courses for the summer term. As usual a wide range of courses with materials content are around and I hope that you are able to attend one and will encourage your students to find out more about materials by signing up for a course too.

Courses for teachers

The Goldsmiths Company run Science for Society courses every summer, designed to improve the knowledge of teachers. This year there are two courses to note, both of which are free to attend (with a £50 refundable deposit):

Materials Science

University of Cambridge, 17 to 22 July 2011

This course provides an insight into the broad field of modern materials, spanning the physical sciences, and engineering and biomedical applications. It includes practical demonstrations and industrial visits. There is coverage of topics as diverse as aircraft materials, integrated circuits and drug delivery. For more information visit http://www.thegoldsmiths.co.uk/charity-education/education/science-for-society-courses/materials-science/

Sustainable energy

University of Bath, 17 to 22 July 2011

This course will provide teachers with an insight into the science behind the issues of energy and the environment and current scientific approaches to solving these problems. The course will be delivered by leading academics researching in these areas and draws on interdisciplinary expertise from the Department's Centre for Sustainable Chemical Technologies and the University's Institute of Sustainable Energy and the Environment.

These themes are directly relevant to the environmental and science and society contexts in the GCSE and A level science syllabi. Teachers should expect to return to school with new activities based on cutting edge research which can be used in the classroom and a greater confidence when discussing these issues with their students. The course will feature a mix of lectures, workshops, industrial visits and informal question and answer sessions. For more information visit http://www.thegoldsmiths.co.uk/charity-education/education/science-for-society-courses/sustainable-energy/

Courses for students

As usual, the Smallpeice Trust is organising a number of courses for students of different ages. The following might be of interest:

Year 9 courses:

- Automotive Engineering at Coventry University (22 to 25 August).
- Engineering Experience at Harper Adams University College (11 to 14 April), University of Wolverhampton in Telford (5 to 8 July), Askham Bryan University College (12 to 15 July).

Year 10 courses

- Engineering materials at the University of Manchester (27 to 30 June).

Year 11 and 12 courses

- Low carbon energy challenge at Newcastle University (25 to 28 July)
- Mining and Minerals at the Camborne School of Mines (18 to 21 July).

The course fee varies between courses so for more information visit www.smallpeicetrust.org.uk

ULTIMATE GUIDE TO CERAMICS PART II

Part I of your ultimate guide to ceramics focussed on understanding the basic types of ceramics and their structure. In this issue we focus on how ceramics are processed.

Clay pit. From http://commons.wikimedia.org/wiki/File:Clay_Pit_near_Dorey%27s_Farm_-_geograph.org.uk_-_114558.jpg courtesy of David Squire.

Throwing a clay pot on a potter's wheel. From http://upload.wikimedia.org/wikipedia/commons/e/e6/Potter_at_wheel.jpg

Where can I find out more?

I sourced most of the information for this article from http://en.wikipedia.org/wiki/Ceramic_engineering.

However the best way to appreciate ceramic processing is to have a go yourself. Many colleges run courses and I can recommend giving it a try!

Introduction

We have been using ceramics for thousands of years to provide shelter, cooking vessels and in more recent years, technology for communication around the globe. Although at first glance the four different groups of ceramics (structural ceramics, refractories, whitewares and engineering ceramics) appear to be quite different, when it comes to processing them they are all very similar.

Once the material has been won from the ground a number of common steps are involved: milling, batching, mixing, forming, drying, firing and assembling. This processing route is designed to give the ceramic the desired microstructure and therefore properties for the job it needs to do.

Clays are the most common raw materials and these can often be formed directly without any modification.

Milling involves breaking the material down in to smaller particles by crushing or grinding. Milling will generate particles in a range of sizes and it is sometimes important to sort and grade these in order of size.

Batching is a bit like baking and involves weighing the different oxides required by a particular recipe. These powders are then mixed. In some cases the powders are then dried, in others they are mixed with a liquid binder.

The **forming** stage is the key part of the whole processing operation and involves shaping the powder to the desired geometry. A wide variety of techniques can be employed depending on the state of the raw material and the final shape desired. These include:

- The easiest way of processing clay-based ceramics is to simply sculpt them by hand and this process has been used for many centuries. However, modern techniques allow more complex shapes to be produced.
- Throwing is probably the most familiar way of processing ceramics as it can be used for making pots, vases and bowls. The process involves manually manipulating clay

as it moves on a rotating platform.

- Slip casting requires a suspension of ceramic particles in water or another binder. The clay suspension is poured into a porous mould; the liquid is absorbed by the mould leaving a layer of ceramic particles on the walls.
- **Extrusion** and **pressing** are also relatively wet processes and involve shaping clay by forcing it through a die (for making bricks for example) or by pressing it in to a mould.
- Powder processing involves compacting dry or slightly damp powder to produce a product which can be handled before firing. The compacting pressure can be applied along one axis (unidirectional pressing) or in all directions (isostatic pressing).

The formed ceramic is said to be in a 'green' state, that is, it can be handled but it is delicate and soft.

The next stage involves **drying** the green component to remove water or the binder. Care is necessary during this process to make sure that the material dries out evenly without cracking.

During the **firing** stage the ceramic is heated to a high temperature, typically over 1000°C. At this temperature the microstructure of the material changes as the oxides are chemically bonded together. In the case of powder processes this stage is called **sintering**. The component will shrink during firing or sintering as pores in the material are removed. This shrinkage must be accounted for when making the green component.

These processes will all result in the production of a crystalline material but sometime it is necessary to make a non-crystalline or glassy material. Technically speaking a glass is a material in which the atoms only show short range order (compared to a perfect crystal such as diamond which shows long range order or an amorphous material which shows no order at all). The material that we think of as glass is essentially silica that has been melted and processed by either blow moulding (bottles) or float processing (flat sheets). In both cases the viscosity must be controlled during forming to ensure that the component will hold its shape and then the cooling rate controlled to ensure that detrimental residual stresses do not form.

THE CERAMICS SOCIETY NEEDS YOU!

The Ceramics Society is one of seventeen technical communities of the Institute of Materials, Minerals and Mining focusing on meeting the needs of its membership with an interest in all aspects of ceramics.

An important focus within the Ceramic Society has always been the promotion and support of education and training relating to ceramic materials.

To this end the society would like to find out from you how they can best support the teaching of ceramics in schools. Enclosed with this newsletter you should find a short questionnaire asking how you feel they can best target their efforts.

Please would you spend a few minutes of your time to complete the questionnaire and return it to me at the address provided.

Many thanks!

EDUCATION AT IRONBRIDGE

The Ironbridge Gorge in Shropshire is a fabulous place to visit, not only because of the beautiful scenery, but because of its industrial heritage. This area is regarded as the birthplace of industry and is where the industrial revolution began on the eighteenth century.

Ironbridge Gorge is now a world heritage site and the venue for a number of interactive museums chronicling its history and exploring materials and engineering.

Of particular interest is the Ironbridge itself. Constructed in 1779 it was the first bridge to be made from iron and was built using many techniques drawn from wood working. One of the newest additions to the suite of museums is Enginuity. Here is it all about hands-on exploration of materials and systems with a wealth of interactive exhibits.

You can book an organised visit around all of the museums and find out more by visiting www.ironbridge.org.uk

ASE ROUNDUP

As usual this year we attended the ASE Annual Conference. This year the event was held in Reading and we had a stand in the exhibition hall for the duration of the event.

The ASE meeting is always a great way to start the year with the chance to meet some new teachers and some old friends and to network and find out what other like minded organisations are doing.

Here is a roundup of some of the useful things that I found out about...

Modelling crystal structures.

Ever since I stuck my fingers together playing with polystyrene balls and a hot glue gun I have been looking for a good kit to use to model crystal structures in metals. And just like buses two came along at once this year! We were opposite the Molymod stand and spent quite a while playing with their excellent models. They have some great kits showing structures in organic chemistry and polymers and large macromolecules such as diamond. You can find out more by visiting www.molymod.com.

If you really want something large and spectacular to demonstrate body centred cubic and face centred cubic crystal structures then Cochranes of Oxford are for you. Their models are more delicate than those of Molymod and they give a really great impression of atomic planes and the symmetry in structures. You can find out more about them at http://www.cochranes.co.uk/.

The Bradford Robotic Telescope

I know this hasn't got much to do with materials, but I was a passionate astronomer as a child and this resource really grabbed my attention as something that was quite unique. The BRT gives students the chance to take images of the cosmos using a research-quality telescope high on the mountains in Tenerife. They can then process the images and use them to discover everything about the galaxies, stars and planets that we can see in the night sky. You can subscribe to use the facility and this incudes a visit to your school.

I think that this is a brilliant resource and you can find out more by visiting http://www.telescope.org/

Toby White gives an insight into where our silver comes from

WHERE DOES SILVER COME FROM?

It is always worth remembering that there are only eight elements which constitute more than 2% of the earth's crust by weight, and one of the those is oxygen (over 46%!) Silver makes up just 0.000007% (or 0.07 parts per million) which means that (in common with all other metals) it can only be extracted from parts of the earth where it has been concentrated by some geological process or another. Silver is found in native form as nuggets, but not in sufficient quantity to extract. Usually, it combines with elements such as sulphur or chlorine to form argentite (Ag_2S) and chlorargyrite (AgCl).

Silver production in 2005 with relative amounts produced given by colours. (Green largest producer, red smaller producers) . From http://en.wikipedia.org/wiki/Silver

What is interesting about silver is that these minerals are usually found in association with other ore bodies, such as copper, copper-nickel, gold, lead and lead-zinc. Indeed, in many situations, silver is really a by-product (allbeit a valuable one) of other metals. Approximately 25% of the silver produced comes from ores which are mined for their silver value; the other 75% comes from ores actually mined for their major metal value; either lead, copper or zinc.

Silver mine in Nevada from http://pubs.usgs.gov/fs/2005/3023

In some mines, the proportion of silver and the revenue it produces means that it can justifiably be called a "silver" mine. For example, in 2008 one of the largest silver producing mines (the underground Fresnillo mine operated by Penoles in Mexico, http://www.fresnilloplc.com/operations/) processed 1.75 million tonnes of ore, and from it produced 794t of silver, 8,500t of zinc, 6,500t of lead and 0.5t of gold. The effects of the global economic downturn can be seen by comparing production with 2006, when 1,047t of silver were produced!

Silver bearing ores are mined by underground and open-pit methods. As most of the ores with which silver is associated are sulphides, they can be separated from the gangue (waste) minerals using a technique called froth flotation, producing a 30 to 40 fold concentration. Lead concentrates usually contain the most silver, but it will also be found in concentrates of copper and zinc. The processing of each concentrate varies, but all involve smelting.

The metallic silver produced then goes on to be processed in a number of different ways.

SILVER

- Silver has atomic number 47 and atomic mass 107.87. It sits in the second transition series of the Periodic Table with palladium to the left and cadmium to the right with copper above and gold below.
- Silver melts at 962°C and boils at 2162°C; its density at room temperature is 10.49gcm^{-3}.
- Silver has a face centred cubic crystal structure and is therefore very ductile and malleable. It has a Vickers Hardness of 251, making it slightly harder than gold (H_V 216) but softer than copper (H_V 369). It has a Mohs Hardness of 2.5.
- Silver is a lustrous white metal that can be polished to a high shine.
- Silver has the highest electrical conductivity of any metal but copper is preferred in large-scale applications due to its lower cost.
- Silver also has the highest thermal conductivity of all the metals. However, its relatively high cost again means that other metals such as copper and aluminium are preferred.
- The word silver appears in various forms in the Anglo-Saxon and various Germanic languages. The chemical symbol, Ag, derives from the Latin word *argentum* which contains the root *arg-* meaning white or shining.
- Silver has been known for many thousands of years as it is one of the few metals that occur in its native form in nature.
- Silver has been used for jewellery and coinage since ancient times. The gold-silver alloy electrum has been used in coinage since 700BC.
- Silver inhibits the growth of viruses, bacteria, mould and fungi and can be added to textiles in the form of nanoparticles, for example to reduce odour in socks. Silver-impregnated materials are used in wound dressings and food storage containers.
- Some silver compounds such as nitrates and halides are photosensitive and were for many years used in the photographic industry. However, the advent of digital photography has meant that there has been a decline in the need for silver-based products.
- Silver oxide batteries have a long life and a high energy to weight ratio. As a consequence they are used in small electronic devices such as hearing aids.
- Silver and its alloys are used for making high quality musical instruments. *(I have a silver plated flute – Ed)*

Silver metal. http://upload.wikimedia.org/wikipedia/commons/6/64/SilverUSGOV.jpg

Roman silver coins dating to 295AD. From http://upload.wikimedia.org/wikipedia/commons/3/3a/Argenteus-Constantius_I-antioch_RIC_033a.jpg, courtesy of Classical Numismatic Group Inc.

Silver flasks or flasks containing a silver coin have been used for centuries as it was discovered that the contents stayed fresher for longer. From http://commons.wikimedia.org/wiki/File:Kremlin_Armoury_039.jpg