



The Institute of Materials, Minerals and Mining

WELCOME BACK...

Hello and welcome to the first newsletter of yet another school year. I seem to say this every year, but it looks like this one is going to be busier than ever.

This term I will be travelling around the country visiting schools and there are a few dates left available, see page 4. I am also taking booking for the Spring term and have one date left in Science Week so get in quick. Last year I gave my talk to just short of 4,700 people and the initial feedback from the evaluation forms distributed since Easter is very positive. We will be continuing with this evaluation process this term and your co-operation would be greatly appreciated, the forms only take a couple of minutes to complete.

This November we will be attending the DATA conference at the NEC for the first time. So if you are planning on going please do pop along to our stand and say hello, it would be great to put some faces to names!

Also in November are the third series of Autumn Open Days. I have to say I have been astounded at how quickly these booked up this time and am pleased to see a number of return bookings. Again there are still a few vacancies, see page 2 or get in touch for details.

A couple of other reminders: We are planning something very special for the 2005 ASE conference in Leeds, see page 5 for details. There is still time to get your entries in for the World Materials Day competition (see page 5). There is also still time for your pupils to get their applications in for this years Armourers and Brasiers CORUS Scholarships, details on page 4.

We have now had two meeting of the Advanced Materials Course Advisory Committee and are making progress in terms of developing the specification content and assessment model. We are very close to linking up with an awarding body and are now looking for people to sit on the working groups for each module and write the resource materials. The job advert of page 3 will be appearing in the TES in September, but you have the chance to get in early!

Finally, I hope you enjoy this newsletter, it broadly has the theme of materials and food. Don't forget, if you have any comments, suggestions or articles please get in touch, it would be great to hear from you.

**Schools
Affiliate
Scheme**

Issue 18

Autumn Term 2004

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Chocolate Heaven for Materials Engineers

The new edition of 'Takes you in all directions,' our main careers publication will be winging its way to you in the very near future and to give you a taster of what is to come, here is one of the profiles from the new publication. As a bit of a chocoholic I think this chap has pretty much the ideal job! Chocolate production is a very complex procedure and is in fact very similar to processing any other material. Firstly you have to extract the useful product from its source (in this case getting cocoa out of the beans, or it could be extracting iron from its ore). After a number of processing stages you then have to cast the liquid in to a mould. This could be casting steel slabs or far more deliciously casting chocolate into bars. During this casting stage many of the same conditions have to be controlled, particularly cooling rate as this affects the final crystal size in the chocolate and so its texture in the the mouth. Anyway I'd better get on with it, I feel a trip to the sweetie shop coming on...

Richard Young, is 31 and an Operations Manager for Mars Confectionary

Richard studied for an MEng in Materials Engineering at the University of Birmingham and now has every child's dream job – he works with chocolate! He is responsible for the manufacture of a multitude of well known Mars confectionery brands, utilising the skills of around seventy people. Unlike other roles he has fulfilled, his current position is heavily involved in manufacturing design and engineering and has a strong emphasis on people management. The role also requires strict pipeline management from raw materials and packaging to despatch and operations.

Richard's favourite project involved managing a team looking at the modification of a chocolate process, by which the processes used to make a key Mars brand would be radically transformed. Although he would love to expand further, Richard explains that the highly sensitive nature of the information it would be more than his jobs worth to say any more.

Richard enjoys his job because no two days are the same. He says that the company has a strong set of work values and ethics and this is what sets it apart from most manufacturing divisions and with everyone aligned in the same way it is often a very exciting environment in which to make a difference.



NOVEMBER OPEN DAYS

As you are probably aware, this year we are co-ordinating the third series of Autumn Open Days to support the teaching of the materials topics in advanced level courses in physics, chemistry and design technology. I have been quite amazed by how quickly places have booked up but there are still spaces left. I would strongly recommend that you take your students along to one of these events if at all possible. They are an excellent way of putting theories learned in the classroom into practise and are also useful for gaining an insight in to a university department.

Spaces are still available at the following venues all in November:

Birmingham:	10 and 24, 1030 to 1230	Loughborough:	09 and 11, 1000 to 1230
Cambridge:	02 or 09, 1230 to 1530	Nottingham:	10, 1000-1230 and 1230-1530
Imperial:	24, 1230 to 1600	QMUL:	10, 1000-1230 and 1230-1530
Leeds:	17 and 24, 1300 to 1500	Sheffield:	03, 17 and 24, 1300 to 1530
Liverpool:	17 and 24, 1230 to 1530	Swansea:	03, 10, 17 and 24, 1230 to 1500
LMU:	05, 12, 19 and 22, 1400 to 1700		

If you would like to book a place on any of the above events please contact Diane Talbot as soon as possible. The closing date for bookings is **Friday 15 October 2004**.

DATA CONFERENCE 2004

We will be attending the Design & Technology with ICT show for the first time this year and we would really like to see you. This is the 27th show and will feature 130 stands displaying equipment and resources to support all aspects of technology in schools. Entry to the show and the associated seminars is free, as is parking at the NEC. You may also be able to get subsidised travel (see below).

The exhibition will be taking place between the 18th and 20th of November in Hall 10 of the National Exhibition Centre just outside Birmingham. We will be on stand number A35 at the far end of the left-hand wall as you come in through the main doors to the hall.

At our stand you will be able to see the wide variety of samples that I bring into schools to include in my talk and you will be able to book a visit. Also on our stand will be careers literature for you to take away and the chance to chat with us about how we can best support your teaching.

If you are planning to travel to the show as part of a group then the ICHF may be able to meet all or some of the costs of your travel.

- If a group of 20 or more teachers, advisors or technicians are travelling to the conference the ICHF will pay for the full cost of hiring a coach.
- If 6 or more teachers / technicians are travelling to the conference in a minibus then a subsidy of 40p per mile is available from the ICHF.

If you would like more details about the travel subsidies you will need to contact the ICHF on 01425 272711 (telephone) or 01425 279369 (fax) or e-mail them at info@ichf.co.uk

ICHF Ltd are based at Dominic House, Seaton Road, Highcliffe, Dorset, BH23 5HW. Their web-site is www.ichf.co.uk/d+t where you will be able to find more details about the conference.

EXCITING OPPORTUNITIES New Curriculum Development

The Institute of Materials, Minerals and Mining is undertaking a major initiative to develop to trial a new GCE A-level course in "Materials", which is anticipated to commence during September 2006.

Striking a balance between the current science and D&T subjects the new course will develop students' scientific understanding concerning how materials are applied. The course will be modern in approach and will demonstrate concepts via real life case study applications. It will engage students of all disciplines and will be innovative in establishing a link between the science and D&T departments in the teaching of the course.

The involvement of teachers, curriculum specialists, educational writers, industrialists and academics is now sought to create the materials for this new course. Those selected will have the necessary understanding and knowledge of the materials subject area to create an innovative curriculum, which will reflect the materials discipline as a whole.

Project Editor

An exciting and demanding opportunity to take a lead role in the creation, implementation and editing of the curriculum and associated teaching materials. Developing and maintaining partnerships with key stakeholders the Editor will work with the Project Director and up to six individual work groups.

Curriculum Advisor (part time)

A specialist having previous experience in the development of curricula you will work closely with the Project Director to provide advice and guidance on the strategic development and planning of the Materials course.

Authors

We seek up to six specialist writers with recent experience in writing science based educational material for schools.

Working Group Participants

Up to six work groups are planned to develop elements of the AS and A2 level course. We seek volunteers to help in the development of the course contents and teaching resources, for teachers, technicians and students.

If you would like to register an interest in any of the above positions please e-mail dallas.dinsmore@iom3.org by **Friday 30 September 2004**.

DIANE'S DIARY

The Autumn term is looking as busy as ever, here is where I'll be!

- 9-10/09 UCAS Convention, Aberdeen University
- 16/09 King Edward VI School, Southampton
- 17/09 Peter Symonds College, Winchester
- 22/09 King Edward VI School, Handsworth
- 23/09 Rolls-Royce Masterclass, Birmingham
- 24/09 Our Lady Queen of Peace School, Skelmersdale
- 29/09 Alsager School, Stoke on Trent
- 30/09 *Sir John Dean's College, Northwich*
- 01/10 Stowe School, Stowe
- 05/10 Ampleforth College, nr York
- 07/10 *North Axholme School, Crowle*
- 12/10 Lutterworth Grammar School, Lutterworth
- 13/10 Aquinas College, Stockport
- 15/10 Colyton School, Colyton, Devon
- 20/10 Brantwood School, Sheffield
- 21/10 Lady Lumley's School, Pickering
- 02/11 Staffordshire LEA Inset
- 03/11 Spen Valley High School, Liversedge
- 04/11 River Leen School, Nottingham
- 06/11 TTA Conference, Dundee
- 10/11 *St Martins Ampleforth, nr York*
- 12/11 Kirklees LEA Inset at Shelley High School
- 15/11 Cheltenham College, Cheltenham
- 18-20/11 DATA Conference, NEC Birmingham
- 22/11 Techniquet, Cardiff
- 01/12 Millom School, Millom Cumbria
- 08/12 Hurtpierpoint College, Hassocks
- 09/12 William Parker School, Hastings
- 10/12 Queen Mary's College, Basingstoke

As you can see I am pretty booked up, but I do still have the following dates available:

- 08 Oct if you are en-route between Sheffield and Aberdeen
- 14 Oct if you are en-route between Sheffield and Devon
- 27 or 28 Oct (I think this is most schools' half term)
- 02, 15 or 16 Dec

Dates for the Spring term 2005 are going like the proverbial hot cakes. These are the remaining dates:

- January: 12, 13, 14, 21, 26, 27, 28
- February: 02, 03, 04, 10, 16, 17, 18, 23, 24
- March: 02, 03, 09, 18, 23, 24, 30, 31

If you would like to discuss a visit or book one of the above dates please contact me first by e-mail as I am difficult to catch by phone. Alternatively you can ring our main number (01302 320486) and speak to Susan or Anita if I am out of the office. They will be able to book you in provisionally.

Evaluation of School Visits

As I mentioned in the summer newsletter we are trying to evaluate the effectiveness of the school visits, initially by surveying teachers. This is to allow us to gauge whether the presentations and activities are meeting the needs of schools in terms of supporting the curriculum and promoting careers.

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

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

I will be posting evaluation forms out to those schools I will be visiting this term very shortly.

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

New from the Armourers and Brasiers

The Armourers and Brasiers' Company have recently launched a new web-site on which you can find details about the Company and their many activities to support materials teaching in schools. You can find their site at www.armourersandbrasiers.co.uk

This seems like the ideal chance to give you a final reminder about this year's scholarship scheme. Once again this year the Worshipful Company of Armourers and Brasiers' and CORUS are offering scholarships for students in the lower sixth (year 12) that are interested in pursuing a materials-related career. The scholarships are worth £250, which will be presented to the successful students at the beginning of their upper sixth year. If the student then carries on to study at one of the participating Universities the scholarship will continue. For further information about the scholarships and an application pack contact Carolyn Green, on 0121 414 5175 or e-mail c.a.green@bham.ac.uk.

MMM THEME DAY

At the ASE Conference 2005

We are planning something very special for the ASE conference in Leeds next January. On the first day of the conference, Thursday 06 January 2005, we will be hosting a theme day to celebrate all that is wonderful about the fields of materials, minerals and mining engineering. The day will feature talks on technical subjects and resources which are available to support the teaching of the materials, minerals and mining topics in the secondary school curriculum, hands-on workshops and an evening reception. The full programme is given below.

- 0930 - 1030 Living in a Materials World
Dr Diane Talbot, IoM³
- 1030 - 1115 The Science and Engineering of Materials for the New Millennium
Dr Rik Brydson, Institute for Materials Research, University of Leeds
- 1115 - 1200 Leeds and the Global Minerals Industry
Darren Dixon-Hardy, Dept of Minerals & Mining Engineering, University of Leeds
- 1200 - 1230 What are Rocks Made of?
Philip Murphy, Earth Science Education Centre, University of Leeds
- 1230 - 1300 Sent to the Tower – Science Lives
Mandy Martin-Smith, Royal Armouries, HM Tower of London

These lectures are open to all and you are welcome to pop in and out as appropriate

- 1400 – 1600 After lunch there will be two parallel workshops. Places are limited and you can book your space through ASE. There is a charge of £8.00 to attend.

Materials

Institute of Materials Research

This workshop will cover four topics:

- 1 Metals, polymers and powders
- 2 Microscopy and nanotechnology
- 3 Glasses for fibre-optic communications
- 4 Electronic materials

Minerals and Mining

Department of Minerals and Mining Engineering

This is an interactive workshop consisting of a series of demonstrations illustrating the physical and chemical techniques used to convert galena (the main ore of lead) into the main components of a modern car battery.

In the evening we will be hosting a special reception at the Royal Armouries Museum in Leeds.

Transport will be laid on to and from the venue and as such attendance is on a ticket only basis and there are a limited number of places. The Royal Armouries are opening their War Gallery for delegates to explore. In this gallery you will have the chance to meet staff and discuss how students can enjoy learning through hands-on sessions. You will also be able to see the many ways in which science and technology have played crucial roles in the development of arms, armour and castles through the ages. A buffet dinner will also be provided. If you would like to attend the evening reception please fill in the form at the bottom of the page and post it back to the address given by the end of November so that we can post the tickets out before the Christmas holidays.

ASE CONFERENCE 2005, Evening reception at the Royal Armouries

Please complete clearly in BLOCK CAPITALS

I would like to receive _____ tickets for the evening reception at the Royal Armouries on 06 Jan '05.
The names of the delegates attending the reception are:

Please post the tickets to:

Please return your completed form to: Dr Diane Talbot, Institute of Materials, Minerals and Mining, Danum House, South Parade, Doncaster, DN1 2DY or fax to 01302 380900 by 30 November 2004

MATERIALS FOR FOOD PACKAGING

The broad theme of this issue of the newsletter is materials for food, so I thought it might be quite interesting to have a look at the materials that are used in the packaging of the food we eat.

Ever since Man started storing food to consume at a later date we have had to develop materials and methods for packaging it. Simple storage methods would have involved wrapping food tightly in leaves (for example those from the banana plant) and maybe putting it at the back of a cave or in a hole in the ground to keep it cool.

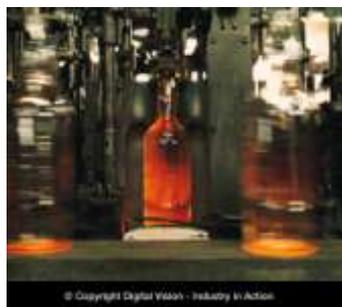
Later ceramic pots were made to store liquids and solids. The ancient Egyptians used ceramic pots to store food and water (and sometimes internal organs during the mummification process). A clay-like mud from the banks of the Nile was used to make pinch, slab and coil pots.

Hand-made and later wheel-turned pots were used from the Bronze Age onwards to store and transport foodstuffs. The Romans called these pots *amphorae* and they used them to store olive oil, fish sauce and wine, amongst other things. The vessels could be up to a metre tall and contain 50kg of food.



Images from left to right: Egyptian storage vessel, Bronze age storage pot, Spanish fish sauce vessel, Iron Age storage pot from Cyprus.

Modern day packaging is generally far more sophisticated and has to fulfil more than simply keeping food dry and in hygienic conditions. The packaging must appeal to the target market, allow storage for various periods of time from days to years, satisfy a particular brand image, allow for safe disposal and in most cases be inexpensive. Alongside these criteria the packaging must not interact with the food (for example corrosion in an acidic food), must not let air in or out and must not leach chemicals in to the food stuff.



A wide variety of materials are used for packaging our food today:

- ❖ Glass bottles and jars have been used for many years for packaging liquids (fizzy drinks, milk, beer and wine) and solids (jams and sauces). Glass is made from silica, limestone, soda ash and recycled glass. These raw materials are melted together and formed into new containers. The containers are filled, sealed and distributed to consumers. Glass recycling points are widely distributed and glass can be recycled an infinite number of times. Closures have become an increasingly important aspect of glass packaging in recent years, particularly for wine bottles. Many companies are moving away from traditional cork closures to stoppers made from polymers or even screw top lids. Natural cork contains a mould which can react with chlorine during bleaching to produce a chemical called trichloroanisole which can taint the wine with a dull, musty taste. The alternative materials eliminate the possibility of tainting the wine as they do not react with the liquid.
- ❖ Metal cans are widely used for packaging a range of foodstuffs. Steel cans coated with a thin layer of tin have been used for many years for packaging a wealth of different types of food, in fact the first use of a tin-coated iron can dates back to 1813. Steel cans allow food to be stored for relatively long periods of time. Once the can is sealed it is air tight and can be heated to between 116 and 121°C to destroy micro-organisms. This process can be used for packaging virtually any type of food, liquid or solid. The original cans required a hammer and chisel to open them but nowadays some cans don't



even require the use of a tin opener. Modern cans also allow acidic foods such as tomatoes to be packaged. The inside of the can is now coated in a polymer layer which does not react with the acidic juices in the food. Every year we use a huge number of fizzy drinks cans made from steel or aluminium. These offer the ideal packaging solution for carbonated drinks as they are strong, impermeable to carbon dioxide and allow easy branding of the product. Product identity is of particular importance to the fizzy drinks market and new labelling techniques such as direct printing on to the metal surface and shrink wrapping plastic labels allow this to be achieved with relative ease.

Another advantage of cans is that they can easily be stacked many units high minimising the amount of floor space needed for storage.

- ❖ Polymers are widely used in packaging. Polyethylene terephthalate or PET is the preferred material for containing carbonated drinks as it has sufficiently low permeability to prevent loss of the carbon dioxide. Bottles are made by injection blow moulding. Firstly a pre-form or parison is made which looks very much like a boiling tube that has a screw thread on the top. The next stage involves blowing the bottle up like a balloon. The screw top is clamped to prevent it from deforming and the heated parison is inflated to the desired bottle size. The screw top lids from different sized bottles will sometimes be interchangeable as they have been made from the same type of parison. PET bottles can easily be recycled if the material is sorted from other types of plastics. Polymers are also widely used to package fast foods and fresh foods, particularly in the form of plastic films. Each year in the UK we use almost 750,000 tonnes of plastic films for carrier bags, shrink wrappers, food bags and wraps for a whole host of products including confectionary, soup, dairy products and drinks. Materials such as low density polyethylene (LDPE) protect food from the atmosphere and can easily be printed with customer information. One of the key advantages of polymer films is their low weight, meaning that they are energy efficient to transport.



- ❖ Card and paper cartons have been used for many decades to store foods. We are all familiar with the traditional milk carton, but paper based products are used for packaging so much more. Boxes are used for storing dry products such as cereal, frozen goods and confectionary. Cartons are used for storing a wealth of drinks and soups. Cartons are strong, rigid, stiff and tough, allowing safe transportation of the products. Carton board is made from a number of layers of pulp (cellulose fibres) originating from wood. The top layer is often made with a white pigment and can easily be printed. The boxes and cartons are cut out of a flat piece of board. They are then scored, folded and glued together to make 3D boxes. This form of packaging is environmentally sound as the product is made from a renewable source, can easily be recycled and is biodegradable.
- ❖ In recent years composite packaging materials have become more prevalent. Crisps and other dry products are often stored in aluminium lined polymer packets to keep them fully air-tight and fresh. Polymer coated cartons are also used as they are impermeable to liquids.

Future developments in packaging could be worth millions of pounds to the industry and the latest innovations are in smart packaging of which there are two types:

- ❖ Smart packaging which will benefit the industry such as track and trace tags which use microchip technology to allow products to be traced throughout their manufacture and distribution.
- ❖ Smart packaging which will benefit the consumer. The first innovation of this type was the widget in beer cans that was introduced in the 1980's. Other systems include self-heating and self-cooling products, particularly useful when eating on the go. Thermochromic panels can be printed on to containers to indicate when the food is hot or cold enough to consume. Other smart sensors may detect when food is rotting. Smart polymers are being developed which will slow the rotting process as they incorporate anti-microbial agents or oxygen scavenging molecules.

There is no doubt that more exciting new developments will be heading our way soon so watch the shelves in your local supermarket!

SODIUM



- Sodium is an extremely reactive, silvery-white metallic solid at room temperature and is soft enough to be cut with a knife. The cut surface dulls rapidly when exposed to the air and moisture.
- The word sodium originates from the English word *soda*, however the chemical symbol Na comes from the Latin *naturium*.
- The alkali metal has atomic number 11 and atomic mass 22.99. It melts at 97.72°C and boils at 883°C.
- Until the 18th century no distinction was made between potassium carbonate or vegetable alkali which originated from deposits in the earth and sodium carbonate or mineral alkali which originated from wood ashes.
- In 1807 Sir Humphrey Davy isolated sodium by the electrolysis of very dry NaOH, where sodium was collected at the cathode. He discovered potassium by the same method in the same year.
- Sodium metal has a body centred cubic crystal structure at room temperature and a density of 968 kgm⁻³.
- Sodium salts burn with an orange / yellow flame and sodium vapour street lights have this characteristic colour.
- Sodium is the sixth most abundant element in the Earth's crust with an abundance of around 2.6%. It is never found in its native state as the element is too reactive. The most common mineral is rock salt or *halite* (sodium chloride). Other sodium containing minerals are mined however these are extracted for the anion rather than the sodium. These minerals include: Borax (sodium borate), Soda (sodium carbonate), Chile Saltpetre (sodium nitrate) and Thenardite (sodium sulphate).
- Sodium is used to displace titanium from TiCl₄ and also for descaling and purifying metals.
- Molten sodium has been used as a heat exchanger in some nuclear reactors.
- Common compounds of sodium are often more important than the element itself and include: common salt (NaCl), caustic soda (NaOH), soda ash (Na₂CO₃), baking soda (NaHCO₃). These compounds are important in the paper, glass, textile, soap, chemical, petroleum and metal industries.
- Sodium is an essential element for the human body and is vital for the regulation of the water content of blood and tissue and for the transmission of electrical impulses for nerve function. It is usually ingested in the form of common salt and its importance to human and animal nutrition has been known since ancient times. The average human body contains around 100g of salt and a daily consumption of 3g is required. Many people consume far too much sodium and this can lead to high blood pressure.
- Sodium polyacrylate is a water retaining polymeric gel which is used in disposable nappies. It can absorb up to 300 times its own weight in water by osmosis. It can also be used in soil or instead of soil to provide a source of water for indoor and outdoor plants.
- Sodium hypochlorite (NaOCl) is commonly used as bleach and sodium thiopental (Pentothal) is a fast-acting, barbiturate-based, injected anesthetic.
- Sodium salts have long been used to preserve food. Salting is an ancient technique for preserving meat. Common salt and fresh meat are layered together in a barrel. The salt draws out the moisture in the meat, thus reserving it. Soaking in brine is also commonly used to preserve meats. Modern preservatives such as sodium nitrate, sodium nitrite and sodium benzoate are used for preserving cooked meats and preserve their pink colour.
- Sodium citrate can be added to calcium phosphate bone cement to make it easier to work. This allows cracks and holes in bones to be repaired.
- Household water softeners work by displacing the calcium and magnesium ions in the domestic supply with sodium ions. The sodium ions do not precipitate out causing scale nor do they form a sticky scum with soap.

