



The Institute of Materials, Minerals and Mining

HAPPY NEW YEAR (again!)

Do you know, it doesn't feel like two minutes since I was writing this last year and preparing for the ASE meeting in Leeds. As I am writing this we are preparing for a whole host of exciting events in 2006.

We will once again be exhibiting at the ASE meeting in Reading, see page 2 for more details. Don't forget to come and say hello if you will be there.

The highlight of the early part of the New Year will be Congress 2006 in London. This is the Institutes main biennial conference and following on from the success of the event in 2004 we are once again planning an event for teachers. More details can be found on page 3. We very much hope that as many of you as possible will be able to come along, it is sure to be an excellent day.

As usual I was very busy last term. I hope all of your Advancing Physics students that I spoke to have produced some excellent projects! If you feel any of them are of particularly high quality or cover unusual materials please let me know and maybe we can feature them in the newsletter. I look forward to meeting your students this term too and my diary can be found on page 4. I am pleased to report that the new booking procedure that we implemented at the beginning of September is working well. Thanks to all that returned signed booking forms so promptly! If you would like me to visit in the summer term you will need to get in quick as I am getting married at the beginning of July and will be out of the office from the 5th to the 21st of the month.

Also featuring in this issue are reviews of the D&T with ICT Show and November Open Days. Details of this year's Green Power competition appear on page 6, a rundown of the UCAS conventions where we will be appearing and some information about silly putty are also included.

Finally, I hope you had a great Christmas break and that the Spring term is not too stressful! If you have any questions or comments about the Scheme please get in touch. In addition if you have seen or used a good resource that you think other teachers could benefit from please let me know so I can put an article together and spread the word!

**Schools
Affiliates
Scheme**
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A USEFUL CAREERS WEB-SITE

I appreciate that you are constantly bombarded by publications, some of which are more useful than others, so I have decided to suggest a couple of useful careers sites rather than sending you a load of paper! I hope you find these useful!

www.careersinquarrying.co.uk and www.careersinroadcontracting.co.uk These sites are essentially the same site and it focuses on careers in quarrying and the closely related area of road construction. It features case studies of young people entering the fields through different educational routes and has the facility to be able to order CDs containing more information. There is also a links page with details of the Quarry Products Association, Institute of Quarrying and a number of companies related to the fields. I have recently received a copy of both of the CDs they produce and they contain some interesting information.



USEFUL RESOURCE FOR TEACHING POLYMERS

Do you find it difficult to get samples of different common polymers?

Do you find it difficult to get simple comparative information about common polymers?

If the answer to either of these questions is yes, you might find the **Back to Basics** polymers kits very useful. These kits are produced by Polymer Training Ltd, the UK's primary provider of training products and services for the polymer industry. Three volumes are produced containing a wide range of different polymers, six in each kit. The polymers include polypropylene (PP), polyethylene (LDPE and HDPE), polystyrene (PS), polyvinyl chloride (PVC), acrylonitrile butadiene styrene (ABS), polymethyl methacrylate (PMMA), polyethylene terephthalate (PET), polyamide 6 and 66 ('nylon') and polycarbonate (PC).

The kits are very well presented in a durable polypropylene case which is easy to store and they contain a standard test piece of each material which demonstrates how different thicknesses and shapes of polymer can be injection moulded. These samples are accompanied by an information sheet for each material containing details about the materials properties, comparative values of cost etc. and typical applications. There is also an extensive glossary of terms relating to the materials and the injection moulding process.

I think these kits are an excellent resource, particularly useful for teaching resistant materials and product design. Enclosed with this newsletter you will find a flyer which will provide you with more information about the packs and how you can get hold of them.

ASE MEETING 2006

Just a quick reminder to let you know that we will be at the ASE meeting in Reading from 5 to 7 January. We will be at the exhibition for the duration of the event on stand **C11**, very close to the National Science Learning Centre stand. Please do come along and say hello and let us know what you think of the Scheme. We will have a full display of all sorts of exciting samples for you to play with and if you have not had a visit yet you can find out more about how we can help. I will also have my diary with me if you would like to make a booking. We hope you have a really good conference, if you go!

AT CONGRESS 2006

Materials Congress is the Institute's major biennial conference and covers the complete materials cycle, from minerals exploration and extraction, through processing, product manufacture and applications, to product recycling and land re-use. The last Congress in 2004 provided an ideal and successful opportunity to showcase the latest developments to teachers.

We are planning to hold a similar event again at Congress 2006, which will be taking place across a number of prestigious venues on Carlton House Terrace in London (left), including the Institute's Head Office



The **Schools Day at Congress 2006** will be **Friday 07 April** as we felt the technical symposia on this day were most pertinent to the science and technology curricula and offered a wide range of subject areas. In the morning you will be able to attend sessions on:

- Biomaterials for regenerative medicine
- Chemical design and synthesis of new functional materials
- Innovation of construction materials
- Energy materials
- Materials for future energy systems
- Packaging
- Processing and characterisation of advanced ceramics
- Rolling research to 2010.

In addition to the eight technical symposia there will be two plenary lectures. Professor Alan Windle from the University will be presenting on 'Synthesis of carbon nanotube materials – the Fe-C synergy' and 'Multifunctional (smart?) materials systems' will be presented by Dr Leo Christodoulou from DARPA Defense Sciences Office.

In the afternoon we will be moving over to the Tower of London, where there will be a programme of presentations specifically for you, in the new Education facility. It is hoped that the day will be rounded off with an evening reception at the Institute's Head Office, back on Carlton House Terrace.

The normal registration fee for members to attend Congress for one day is £160, however, if you attend the Schools Day your registration will be **FREE**. It is also hoped that we will be able to reimburse your schools for the cost of supply cover so that you can attend the conference. You will need to cover your own travelling expenses.

At the last Congress two years ago 39 teachers from 26 schools attended and had a great time. The feedback we received after the event was incredibly positive and most relished the opportunity to find out about the latest developments from the international researchers at the top of their fields. We are in the process of putting together a registration form and more information for teachers, but if you would like to pre-register your interest in attending this prestigious event please send me an e-mail (diane.talbot@iom3.org) so that I can make sure you receive a pack.

You can learn more about the conference on our main web-site, www.iom3.org. We look forward to seeing you there!



DIANE'S DIARY

Here's where I'll be in the Spring Term...

5-7/01 ASE meeting, Reading
11/01 Havant College, Hampshire
13/01 Sir John Deane's College, Northwich
18/01 Bungay High School, Suffolk
19/01 Ogmore School, Bridgend
20/01 Birkenhead High School
23/01 Cheltenham College
25/01 Sir Thomas Rich's School, Gloucester
26/01 Birkenhead High School
27/01 Terrington Hall, York
27/01 St Peter's School, York
30/01 Lutterworth Grammar School
01/02 Colfes School, London
08/02 Farrington School, Sunderland
09/02 The Judd School, Tonbridge
10/02 Walthamstow Hall, Sevenoaks
17/02 University of Sunderland
22/02 University of Wales, Newport
28/02 St George's School for Girls, Edinburgh
01/03 Stewarts Melville College, Edinburgh
03/03 St Mary's College, Blackburn
07/03 Staffordshire LEA
10/03 Riddlesdown High School, Croydon
13/03 St John Fisher Catholic High School, Harrogate
14/03 St Aidan's CE School, Harrogate
15/03 SETPOINT Hertfordshire
16/03 Carr Hill High School, Preston
17/03 Our Lady Queen of Peace School, Skelmersdale
22&23/03 UCAS Convention Exeter
24/03 SETPOINT Shropshire
30/03 University of Strathclyde, Glasgow
03/04 UCAS Convention Cardiff
05-07/04 Congress 2006, London

It never ceases to amaze me how far in advance I get booked! If you would like me to come and visit in the remainder of this academic year you'll need to get in quick! The Dates remaining for this term and next are as follows:

Jan: 12
Feb: 15, 16, 23, 24
Mar: 02, 08, 09, 29, 31
Apr: 10, 11, 12, 19, 20, 21, 26, 28
May: 05, 10, 11, 12, 17, 18, 19, 25, 25, 26, 31
Jun: 02, 07, 08, 09, 14, 16, 28, 29
Jul: 24, 25, 26 (and getting married!)

Generally I do visits of Wednesdays, Thursday and Fridays but if you book well in advance this is pretty flexible. As usual, send me an e-mail if you would like to book a visit.

SAS Resource for 2006

The resource for new schools joining the SAS and renewing schools in 2006 will be on the theme of packaging. While being particularly relevant to technology teachers we are keen to emphasise that we have tried to include the science behind the different packaging materials and processes. The booklet will focus in materials such as glass, steel, aluminium and plastics and their use in packaging. It will also look at the process involved, such as blow moulding and deep drawing. Smart materials in packaging will also be explored along with historical and environmental impact of packaging.

We very much hope that you enjoy this resource and find it a useful aid to your teaching. If you have any comments, criticisms or other feedback about this or any of the other resources we have issued to members please do let us know. You can contact me on 01302 380902 or at diane.talbot@iom3.org.

D&T with ICT SHOW

The D&T with ICT Show was once again held at the NEC and took place between the 17th and 19th of November. We had an exhibition stand for the second time and felt that, despite a very slow start on the Thursday, it went well. We managed to speak to a large number of teachers and handed out lots of information. It was also nice to see some faces that I've not seen for a while. Thanks to all of you that came to say hello, and welcome to those of you that joined after the event. Don't forget to get in quick if you would like me to visit!

SILLY PUTTY- Really useful fun stuff!

During the talk that I give in schools, one of the favourite materials of students, teachers and I have to admit, myself, is the silly putty. But this fun material is actually very useful and I thought it might be worth making those of you that haven't seen my talk aware of this wonderful gooey stuff!

Silly putty was discovered in 1943 by a Scottish engineer, James Wright, working for General Electric in Connecticut. During the Second World War the supply of rubber in to the US was being cut off by the Japanese and so the government set industry the task of developing a synthetic alternative. James Wright mixed boric acid with silicone oil and **polyborosiloxane** was born. This new polymer did not win widespread use and it was not until 1949, when Peter Hodgson bought the production rights from GE and changed its name to silly putty that it found fame as a toy.

Silly putty has found a wide number of everyday uses around the home such as stabilizing wobbly furniture and picking up dirt and dust. It has been used in medicine as a physiotherapy tool and as a stress relaxer. It has even been into space, the astronauts on Apollo 8 used it to hold their tools down in zero gravity.

Silly putty has unusual rheological or flow properties, it is a non-Newtonian fluid with dilatant behaviour. This means the material becomes thicker or more like a solid as the rate of deformation or shear rate is increased (this is the opposite to non-drip paint or tomato ketchup that are thixotropic, they get runnier with an increase in the rate of deformation). This can be demonstrated simply with a piece of silly putty. Roll the material into a short fat cylinder and pull the two ends apart very slowly. The material will stretch by a vast amount and eventually break under its own weight when the cross section has thinned almost to a point. Roll the cylinder again but this time pull the two ends apart as quickly as possible. You may notice that there is more resistance to the deformation this time and that the material does not extend very much at all. If the silly putty is quite cool it will actually snap. This is a useful way of demonstrating the importance of testing any material or component under similar rates of deformation to those it will experience in service. It can also be used to demonstrate the change in behaviour with strain rate that is seen in other engineering materials. For example car body panels are produced by stretch forming and the steel or aluminium used will stretch further without cracking if slow deformation rates are used. The change in properties is due to the shape of the polymer molecules which have large side chains coming off the central backbone. When pulled slowly these side branches can move past each other and allow stretching. When pulled quickly the side chains become tangles and knotted together, preventing stretching and the material snaps

The dilatant behaviour of silly putty is exploited commercially in a process called Abrasive Flow Machining. In this process silly putty is mixed with fine abrasive particles (such as alumina or silicon carbide) and the mixture is extruded across surfaces and edges or through complex cavities in components. In an unconstrained state the material will flow easily (behaving more like a liquid), however once it is in contact with the component the shear rate increases and the material behaves more like a solid, gripping the abrasive and machining the component. This process is used in the aerospace, automotive and medical industries to machine complex components to close tolerances.

Small quantities of silly putty can be obtained cheaply from all good toy shops where it can be found in small plastic eggs. This quantity is plenty for demonstrating the deformation behaviour. You can also buy 'Thinking putty' from Firebox.com in a variety of colours. My favourite is the thermochromic stuff that is purple when cold but pink when it's hot, a sort of super-smart material! Alternatively you could try making your own version of silly putty which will show similar properties but will not stretch to the same extent. Mix 4 teaspoons of PVA glue with 1 teaspoon of saturated borax solution and mix well (you may need to play with these quantities slightly). Initially you will need to mix the ingredients with a spoon, glass rod or wooden stick. After a while the mixture will become tacky and you can remove it from the container and knead it with your hands. Small quantities of food colouring may be added to colour the material. A similar demonstration can be done with a thick paste made from corn flour and water as this has the same sort of properties. Have fun but remember don't get it on your clothes!! (It may stain!)

THE GREENPOWER 2006 FORMULA 24 NATIONAL FINALS



The front row of the grid.

The seventh National Final of Greenpower Formula 24 was held at Goodwood Motor Racing Circuit in West Sussex on the 16th of October. Nine regional heats were run over the summer the seventy-five qualifying cars from all over the UK attended the final.

Formula 24 is designed to introduce students to engineering at an early age in order to stimulate an interest which will carry over into subject and career choices as they move through school. Started in 1999 as a purely Sussex event, it quickly spread and now has now involved over three hundred UK schools.

The seventy-five F24 cars were joined by three of the newly launched F35 cars for sixth-formers and colleges, who started at the back of the grid. ‘Turbo Tortoise’ from Furze Platt School, which had won the Race of Champions in May 2005 setting an extraordinary six-hour distance of 201 miles, was the obvious favourite, although a couple of problems in the qualification heats put them at seventh on the grid. ‘Fireblade’ the wooden rocket from nearby St. Philip Howard R C High School, champions in 2002 and 2003, led as the field streamed down the main straight after the first lap. It held on for a few laps before it succumbed to ‘Turbo Tortoise’. The race was exceptionally close for the first four hours when ‘Turbo Tortoise’ never got more than two laps ahead of ‘Fireblade’ and a gaggle of five other fast chasing cars. In the middle of the field, a mere ten laps covered fifty-five cars at the halfway point in the race. A short and very sharp thunderstorm sent the cars running to the shelter of their garages for half an hour but they emerged again to finish the race. The wet track slowed the whole field down and there were many interesting spins and slides at the infamous Goodwood chicane. However, ‘Fireblade’s’ race fell apart when it bent its front wheels in an ‘off’ at Woodcote, and ‘Turbo Tortoise’ took the race. ‘Turbo Tortoise’s’ clone ‘Super Snail’ took second place with a hard-finishing ‘Aluuuuuminium’ from Chatham House Grammar in third place.



Action through the famous Goodwood chicane; second placed ‘Fireblade’ from the local St. Philip Howard R C High School dives through the inside of Portsmouth Grammar School’s ‘Flying Phantom, No 14



The untouchable ‘Turbo Tortoise’, the easy winner of F24’s National Final

The judge from the Institute of Materials, Minerals and Mining awarded the trophy for ‘Innovation in the use of Materials’ to ‘R-Pod’ from Chipping Sodbury School, for its clever amalgamation of a number of different materials in the design.

Bob Gilbert, the chairman of Motorsport Development UK gave away the prizes.

UCAS CONVENTIONS 2006

I hadn't realised until the other day that the Institute has been attending these events since 1999! During that first year we only went to three conventions in Manchester, Sheffield and London. Since then the number of events we attend has slowly risen as we find them a very useful way of interacting directly with students while they are deciding what to do after year 13. This year we will be going to the following seven conventions:

22 & 23 March	Exeter
03 April	Cardiff
09 May	Newcastle
20 & 21 June	Liverpool
30 June	London
04 July	Sheffield
11 & 12 September	Aberdeen

If you have students that are already interested in engineering or those that are not quite sure what they want to do, send them along to talk to us. We can offer advice about courses and careers in materials, minerals and mining that are not biased towards a particular university and can show them where materials have played a key role in the everyday things around them.

NOVEMBER OPEN DAYS A GREAT SUCCESS (again!)

This is the fourth year that we have co-ordinated the November Open Day programme and once again they have been a great success. Around 560 pupils and almost 60 teachers were booked on to 31 events at 13 venues across the UK. My initial look at the feedback forms we have received has shown the events to be doing a great job of supporting the courses you are teaching and the Universities have generally been impressed with the students you have taken.

It is hoped that the programme will be running again in November 2006 and more details will be available in the summer newsletter after Easter. If you would like to attend next year you should make your booking as soon as the forms come out to you as this time a couple of the venues booked up by return of post.

Don't forget that if you missed out in November, most departments are happy to run half or whole day events for schools to support the courses you are teaching at any time throughout the academic year. If you would like to get the contact details for your nearest department please contact me at diane.talbot@iom3.org.

USEFUL MAGAZINE FOR TEXTILE TECHNOLOGY TEACHERS

As I travel round technology departments in schools I am repeatedly asked for information about smart and modern textiles. Although strictly speaking this is outside my remit, (I'm a bit of a resistant materials girl really, though I am making my own wedding dress) I will always try to help where I can and I think I've come up with a cunning plan. At the 100% Design Show in September I met a chap that works for a magazine about modern and innovative textiles called **FUTURE MATERIALS**. He gave me an issue to have a look at and I can honestly say it was fascinating. It contained articles about quantum tunnelling ceramics being incorporated in to electronic devices on clothes, running shoes with sensors to automatically adjust the level of cushioning, aerogel for insulation in extreme sportswear, self-ironing shirts, Nanosphere, a new fabric coating technology and clothing coated with a material which helps dissolve fat to make you thinner(!), amongst other things which were all written in language that was simple to understand. I'm not sure how much it costs to subscribe to this journal but it may well be worth your colleagues enquiring. The contact details are Future Materials, World Textile Publications Ltd, Perkin House, 1 Longlands Street, Bradford, West Yorkshire, BD1 2TP, telephone, 01274 378800, e-mail info@world-textile.net or look on the web-site www.inteletex.com.

SULPHUR

❖ Sulphur is a pale yellow, odourless, non-metallic, brittle solid at room temperature. It melts at around 115°C and boils at about 445°C.

❖ Sulphur has been known since ancient times. Assyrian texts dated to between 600 and 700BC refer to sulphur as the 'product of the riverside,' in the 9th century BC Homer refers to 'pest averting sulphur' and Genesis in the Bible refers to it as Brimstone. It was not until 1777 that Antoine Lavoisier convinced the scientific community that sulphur was an element.

❖ The word sulphur originates from the Arabic word *sulfra* which means yellow. However it also relates to the Sanskrit word *sulvere* and the Latin *sulphurium*.



❖ There is normally no need to make sulphur in the laboratory as it occurs in its native form in nature. It is often found around volcanoes and hot vents.

❖ Sulphur is often present in meteorites and it is thought that the colour of Jupiter's moon Io is attributable to sulphur in a various forms.

❖ Commercially sulphur is recovered from salt domes along the Gulf Coast of the USA using the Frasch process. This process involves pumping superheated water and steam down to the sulphur reserve, which melt it and push it to the surface in liquid form. This liquid cools in large basins and the resulting sulphur is 99.5% pure.

❖ In addition to its native form, sulphur is also found in nature in a number of minerals including iron pyrites (FeS_2), galena (PbS), sphalerite ($(\text{Zn}, \text{Fe})\text{S}$), cinnabar (HgS), stibnite (Sb_2S_3), gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), Epsom Salts ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$), celestite (SrSO_4) and barite (BaSO_4).

❖ Sulphur forms stable compounds with all elements except the noble gases. It is stable in air and water and dissolves in CS_2 . When burnt in air sulphur forms sulphur dioxide, a key component in acid rain.

❖ Sulphur is found as an impurity in coal, oil and natural gas. If the oil or gas contains sufficiently high levels of hydrogen sulphide it is said to be poisoned and can cause stress corrosion cracking of the steel pipes used for transportation.

❖ Sulphur is essential to life and is a minor constituent of fats, body fluids and the minerals which make up bones. It is a key component in proteins and is contained in the amino acids methionine and cysteine. Sulphur is relatively harmless to humans, the average person contains 140g of sulphur and takes in about 1g per day.

❖ Sulphur is toxic to many bacteria and fungi. However, some bacteria thrive in sulphur containing environments around hydrothermal vents, volcanic vents, oil reservoirs and spoil heaps. Acidophilic bacteria metabolise sulphur in to sulphuric acid and can survive down to pH levels of 0 to 0.7. In others hydrogen sulphide replaces water in photosynthesis. It is thought that these bacteria could have been some of the earliest organisms present when the Earth was a mass of volcanic activity

❖ Hydrogen sulphide can be metabolised by humans in small quantities, but large amounts are deadly and cause respiratory paralysis. At high concentrations the characteristic smell of rotten eggs disappears as hydrogen sulphide deadens the sense of smell. It is more toxic than cyanide

❖ It is thought that the Chinese developed gun powder in the 12th Century, by mixing sulphur, potassium nitrate and carbon. This is a crucial component of fireworks.

❖ Sulphur is used in the vulcanisation of natural rubber. This process was developed by Charles Goodyear in 1842 to stabilise the properties of rubber so it was not so sticky at high temperatures or so brittle at low temperatures. Sulphur is also used as a fungicide and fumigant. Some sulphur compounds are used in the bleaching of dried fruits and paper products.

❖ The majority of the sulphur extracted goes into the production of the most important manufactured chemical in the world, sulphuric acid. This is used in the synthesis of fertilisers, polymers and is used in batteries.



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