



**The Institute of Materials, Minerals and Mining**

**Schools  
Affiliate  
Scheme**

Issue 25

Spring Term 2007

### **Welcome to 2007**

Hello there and welcome to the first issue of the Schools Affiliate Scheme newsletter for 2007.

This term promises to be as busy as usual with a hectic schedule of talks and visits. Last term was a record breaker! I visited 54 schools to give 96 talks to just over 3,700 students! I hope you and your students enjoyed that talks that I gave and the activities that I ran and that they have been useful to your teaching. I'm afraid you have left it a bit late to book a visit for this term, but there are still many dates left for the summer term. So if you think your pupils might benefit from a revision lecture or something a bit more light-hearted after the exams are out of the way then please get in touch. As usual you can find my diary on page 4.

Also in this issue a review of the forum in November, which we hosted along with the Materials Department at Oxford and the UK Centre for Materials Education. We found the meeting very interesting and came out with a number of ideas for resources which could be developed over the next twelve months. A big thank you to all of you that attended.

On page 2 you can find out some important information about two new taster courses in Minerals and Mining Engineering which are being run in 2007 for the first time. These courses, which will be run at the University of Leeds and University of Exeter (Camborne School of Mines) will join the extensive suite of courses run by the Smallpeice Trust each year.

With recycling such a hot topic at the moment I thought it might be useful to look at recycling the materials beneath our feet. On page 5 you can find out how Carpet Burns are turning waste carpets in to a useful product.

The SAS newsletter will be undergoing a bit of a facelift for the summer issue and will be transformed in to A5 format. This is your chance to have an input in to the new-look publication. If you have any suggestions for regular features that you would like to see or articles that you would find useful please get in touch. My e-mail address is [diane.aston@iom3.org](mailto:diane.aston@iom3.org). Have a great term!

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## **Big things happen with The Smallpeice Trust**

### **Finding the mining, quarry and mineral engineers of the future**

The high level of demand for qualified miners worldwide has sparked up an unprecedented amount of attention in Mining and Minerals courses. Camborne School of Mines (part of the University of Exeter) and the University of Leeds are seeing renewed interest from students and are now, in partnership with The Smallpeice Trust, launching two brand new Mining and Minerals courses exclusively for year 11 and 12 students.

Sponsored by two of the largest and mining companies in the world, Anglo American and Rio Tinto, students on the courses will discover how the fortunes of mining underpin so much of modern life and how the latest technology is used to limit the impact of mining activity on the environment. Students will also get hands-on experience of handling minerals, learning how they are refined and processed.

Just some of the course highlights include:

- Learning about how minerals are found, mined and processed to their end use
- Finding out more about minerals and their properties and what will happen when they eventually run out
- Understanding how to survey minerals using the latest computerised techniques and equipment
- Crushing, processing and refining minerals using modern machinery processes
- Visiting one of the UK's largest limestone quarries to witness a modern mining operation in action (University of Leeds only)
- Discovering more facts about mining and minerals at the Eden Project's new educational centre (Camborne course only)
- Gaining an understanding of the wide range of career prospects available to mining graduates, including world travel and exploration
- Meeting and talking to young engineers who are already on the path and able to share their advice and knowledge



The courses led by the Smallpeice Trust and run in conjunction with Dr Patrick Foster (Camborne) and Dr Darron Dixon-Hardy (Leeds & President of the Midland Institute of Mining Engineers) will take place from **23-26 July 2007** at the University of Exeter, Cornwall Campus and from **30 July – 2 August** at the University of Leeds. For four days, full board, the course is priced at an introductory rate of **£25** per student.



This is just one particular area of engineering which is being addressed by The Smallpeice Trust. Over the last year, over 4000 young people have benefited from attending one of their courses. Established for more than 40 years, The Smallpeice Trust is an independent educational charity running a broad range of courses designed to promote careers in engineering to young people aged 13-18. The main activities include running highly-subsidised 4-day residential courses across the country providing young people with hands-on engineering time that could change their future. These courses cover a range of projects and skills and take place at universities and other secure venues throughout the UK.

All courses are designed to take students interest in engineering a step further with emphasis on creativity, design and team working. 'Engineering Experience' is a foundation course for Year 9 students which teams them with young engineers from industry who are there to guide students through every stage of product development, from initial concepts to final testing. Other courses include Electronic Engineering, Engineering management skills, Marine technology, Materials technology, Mining and Minerals, Motorsport engineering, Robotic Engineering and Supercomputing. Projects and workshops are based on real-life scenarios and engineering professionals are on hand to offer advice and guidance. During the courses, students will have access to material and equipment that may not be available in school, giving them a unique opportunity to build on their existing knowledge.





**The Institute of Materials, Minerals & Mining**



On 24 November 2006 the Institute of Materials, Minerals and Mining hosted a meeting in London to discuss how Materials Science could be exploited to support the 14-19 curriculum. Although prompted by the introduction of the new GCSE Science specifications, the remit of the meeting was much wider, looking at how the Materials Community can support the materials-related topics in Science and Design & Technology across the 14 to 19 curriculum. In all 37 delegates attended, including 12 science teachers and 5 design & technology teachers. The attendance of teachers was encouraged by the provision of funding for the cost of supply cover and travelling expenses, by the Materials Department at the University of Oxford. Other attendees came from universities, industry, Setpoints, outreach venues and several had experience of developing resources for schools. This rich mix of delegates led to some very interesting discussions.

The Forum was opened by the Chair, Eur Eng Derek Sheehan from Olchfa School, who kept the meeting running on time throughout the day and introduced Paul Malpass, the Leader of the Government's post-16 Science Project based at the National Science Learning Centre, who gave the keynote presentation entitled "A vision for Science Education in the Future". This was followed by a presentation by Chris Williams, AST from Eckington School who told the group of his experience to date of teaching the 21st Century Science course. I think this brought home to the non-teacher delegates the day-to-day problems associated with implementing a new course in a large secondary school. David Hutton, from the Materials Department at the University of Oxford then detailed a possible model for a case study featuring solar cells and explained how the development of case studies like this could be funded through the UK Centre for Materials Education (UKCME).

Once the introductory presentations had set the scene it was time for the delegates to do some work. Three small breakout groups, made up from a cross-section of delegates, were asked to look at possible formats for resources and discuss their relative merits. Following this the groups came up with materials-related topics in the curriculum which they felt were lacking in terms of good resources. Over lunch the six most popular topics that the organisers felt could be developed were identified. After lunch the breakout groups reconvened to discuss two of these topics each and by then end of the session the groups were asked to come up with a wish-list of resources, in whatever format was deemed appropriate, to support each topic. The six areas identified for discussion and development were Smart Materials, Nanoparticles, Materials Testing, Properties, Processing and Structure, Active and Intelligent Packaging, Biomedical Materials and the Use of Materials in Sport. During the feedback and general discussion sessions a number of important points were raised including clarifying exactly what breadth and depth of knowledge is required by pupils on these topics, identifying existing resources, ensuring that any e-resources produced are compatible with school systems and crucially, making sure that teachers are involved and consulted throughout the development process.

Now that suitable topics and possible resources have been identified, the working group consisting of representatives from the Institute, the Materials Department at Oxford and the UKCME will be meeting before Christmas to discuss these in detail and identify possible writers. Early in the new year a meeting will be held to brief the commissioned writers on the objectives and formats for the resources and following an extensive period of development and feedback taking up most of the year, it is hoped that the six resources will be formally launched at the 2008 ASE meeting.

Watch this space for further developments!

## DIANE'S DIARY

The Autumn Term was the busiest ever and it doesn't look as if it will be any quieter this Spring!

- 04-06/01 ASE Annual meeting, Birmingham
- 09/01 Blessed Robert Sutton School, Burton-on-Trent
- 10/01 Winterton Comprehensive School, Scunthorpe
- 11/01 Cheslyn Hay Community School, Walsall
- 12/01 Silverdale School, Sheffield
- 15/01 Lutterworth Grammar School, Lutterworth
- 16/01 Birkenhead High School, Birkenhead
- 17/01 Millom School, Cumbria
- 19/01 Ripon College, Ripon
- 20/01 Bedfordshire DATA Teachers Conference
- 23/01 Archway School, Stroud
- 24/01 Alleyne's High School, Stone
- 25/01 Strathclyde University, Glasgow
- 26/01 Walton High School, Stafford
- 29/01 Saltash School, nr Plymouth
- 30/01 St Mary's Catholic High School, Manchester
- 01/02 Bolton School, Girls' Division, Bolton
- 02/02 Maidenhill School, Gloucester
- 05/02 Forrest School, Winnersh
- 06/02 Chelmer Valley High School, Chelmsford
- 07/02 Farringdon School, Sunderland
- 08/02 John Spendluffe School, Skegness
- 12/02 Cyfarthfa School, Merthyr Tydfil
- 13/02 Durham LEA Heads of D&T meeting
- 16/02 Thornaby Community School, Teeside
- 20/02 University of Wales, Newport
- 21/02 Dulwich College, London
- 22/02 Moulton School, Northampton
- 23/02 Hereford Cathedral School, Hereford
- 24/02 Staffordshire University, Stafford
- 26/02 Ellon Academy, Aberdeenshire
- 27/02 Glenalmond College, Perth
- 28/02 Stewart's Melville College, Edinburgh
- 28/02 Longridge Towers School, Berwick upon Tweed
- 02/03 Erith School, Kent
- 06-07/03 UCAS Convention Crystal Palace
- 08/03 SETPOINT Cumbria Teachers course
- 09/03 Framwellgate School, Durham
- 12/03 *St Aidan's School, Harrogate*
- 13/03 St John Fisher Catholic High School, Harrogate
- 14/03 *SETPOINT Hertfordshire Science Week Event*
- 15/03 *Carr Hill High School, Preston*
- 16/03 Kesgrave School, Ipswich
- 19/03 Erith School, Kent
- 20/03 Old Swinford Hospital, Stourbridge
- 21-22/03 UCAS Convention Exeter
- 26/03 Graham School, Scarborough
- 27/03 Archbishop Holgate School, York
- 28/03 Chepstow School, Chepstow
- 29/03 UCAS Convention Cardiff

Dates remaining for the Summer Terms:

April: 2, 12, 13

May: 17, 18, 22, 23, 24, 25, 30, 31

June: 1, 5, 6, 7, 8, 13, 14, 27, 28, 29

July: 4, 5, 24, 25, 26, 27

## WHAT'S THE FUTURE MADE OF?

Materials UK, the industry-led body formed recently to implement the recommendations of the Materials Innovation and Growth Team (IGT), has produced a booklet entitled *What's the Future Made of?*, which aims to promote the materials industry to young people and highlight the career opportunities that it can provide. The booklet is a response to the IGT's Final report - published in March 2006 - which identified the need for the materials community to engage effectively with young people, especially at an early stage in their secondary education.

Nick Morgan, Assistant Director in DTI's Materials, Engineering and Manufacturing Policy Unit, who led the project said: 'One of the key objectives of the exercise was to make sure that the publication appealed to its intended audience in early Key Stage 3 and I am grateful to SETNET<sup>+</sup> for facilitating a number of school focus groups where we were able to test a mock-up version of the booklet. The students that participated were all extremely enthusiastic and provided a wealth of constructive criticism and new ideas on how the booklet could be improved'.

Commenting on the intended use of the booklet, Nick said: 'We hope that teachers will be able to use it in the classroom not just in relation to the teaching of materials science, but in the broader context of environmental issues such as recycling and climate change, which we found were of particular interest to nearly all the students that participated in our focus groups. We also hope that the booklet will be useful in highlighting the potential career opportunities available within the materials industry in the UK'.

Further information on the work of the Materials Innovation and Growth Team and Materials UK, together with electronic versions of the booklet and the IGT Final report can be found on the Materials UK website: [www.matuk.co.uk](http://www.matuk.co.uk). Paper copies can be obtained free of charge from DTI Publications at [www.dti.gov.uk/publications](http://www.dti.gov.uk/publications).

*Ed: A copy of both of these is enclosed for SAS members*

## Carpet-Burns - unusual recycling!

We found out about this company at the 100% Detail exhibition at Earls Court in September and I thought that you might like to know about them being as recycling of all kinds is a hot topic at the moment.

The founder of the company, Kelly Atkins, came to Materials from an art and design background and came up with the idea of recycling old carpets when she accidentally heated her carpet with her iron (haven't we all had that moment when we've dropped the iron and melted the carpet -wish I'd thought of this though). She realised that the carpet fibres melted and consolidated when heated to produce a hard sheet of material. After carrying out a three year research project on the material she set up the company and now holds the European patent for HTC or Heat Treated Carpet.

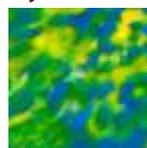
To make HTC unused polypropylene carpet from the manufacturers (end of line waste or faulty batches) is heated and pressed so that the fibres melt and bond. There is no need to add resins or stabilisers during production and the outcome is a 100% recycled product. The pressing process can even preserve the colour and pattern of the original carpet, making for some interesting looking products!

The recycled carpet is produced in sheets of various thicknesses, with a number of finished which can then be used as a substitute for plywood or MDF. The product can be easily cut or drilled using conventional techniques. It can be water or laser cut and welded together. It can also be moulded to produce interesting three dimensional forms.

The recycled carpet sheet is very durable and hardwearing. It is waterproof and non-porous, so has a high resistance to staining. The finished material requires little maintenance and can be used both indoors and outdoors for flooring, seating, table tops, and other surfaces to name but a few of its possible applications!

You can find out more about this fascinating recycled product at [www.carpet-burns.com](http://www.carpet-burns.com)

Staying with idea of unusual recycling at the 100% Design exhibition. **Smile plastics** were exhibiting again this year, and those of you that have seen my talk will no doubt have heard of this company before. Smile plastics use a wide range of waste plastics to produce a variety of different sheet materials. My favourites include those shown below which from left to right are made from: gas (yellow) and water (blue) pipes, whole wellies, water bottles with embedded shredded CDs and recycled mobile phone cases. You can find out all about Smile Plastics at [www.smile-plastics.co.uk](http://www.smile-plastics.co.uk)



# GREENPOWER 2006

## SUSSEX TEAMS ARE BACK ON TOP!

The eighth Greenpower formula 24 National Final was held in glorious Goodwood sunshine and, after a gap of two years a West Sussex car won! Not only that but third place also went to a West Sussex car. 'Turbo Tortoise' from Furze Platt School, competing for a hat trick of wins, was in pole position on the grid, but for the first time was faced with real competition from a number of 'look-a-like' streamliner cars. There was also a good number of fast open wheeled cars still out to show that they were a force to be reckoned with.

Seventy-five cars lined up on the grid and were sent on their way by the Earl of Match at eleven o'clock prompt. By the end of the first lap 'Turbo Tortoise' was several hundreds of metres ahead of second place, 'Slippery Trug'. All the streamliner cars were up in the front of the pack.

It was pleasing to see a large number of Seagull kit cars in various guises making it to the final, demonstrating that, even if there is not a realistic chance of victory, the kits will get you into the final showdown. We welcomed teams from far and wide; our farthest qualifiers were from Banff Academy Aberdeen, with Kit Hill Young Engineers from Helston in Cornwall making a long journey as well.

An hour into the race and it was going very well. The battle at the top looked more like a sprint than an endurance race with the top three cars all on the same lap, 'Turbo Tortoise' just keeping ahead of teammate 'Super Snail' and 'Phoenix'. A gaggle of five open wheelers were two laps behind, led by 'Fireblade' from St. Philip Howard R C High School in Barnham, that had climbed twenty-two places in half an hour! At the back of the field was 'Grinpower' but the 'Alderley Flyer' was still in the paddock.

At the halfway point in the race the 'Slippery Trug' had managed to gain a lap on the 'Phoenix' in second place, and 'Turbo Tortoise' was only a lap behind in third position. As the race progressed the leaders had no chance to let up and the top four cars pushed their drivers to ever longer stints to avoid the time lost at pit stops. The pit control records show conclusively that the top cars stop less. The most remarkable thing about the race was the fact that no cars had dropped out, despite some brisk business developing with the three pick up trailers. With half an hour to go the top five places were occupied by streamliners, with four laps separating the top three cars.

The race finished at five o'clock in brilliant autumn evening sunshine. The 'Slippery Trug' benefited from a late pit stop by 'Turbo Tortoise' to finish four laps ahead, with 'Phoenix' just behind on the same lap. 'Rotary Racer' led in the open-wheelers in sixth place. 'I've Lost My Tractor' won in the 'Most Improved Car' category and 'KHALE.CC' easily won the Best Newcomer. 'Turbo Tortoise' managed to get the fastest lap of the day which was also a new Goodwood lap record.

Sixty-seven cars travelled over one hundred miles and every car that started was still running at the end.



'Tiggers' ninety-six miles and sixty-ninth place resulted in the Perseverance Award from Scaletrix as it got written off at the Essex heat at Dunton, re-appeared at Bedford Autodrome to find its steering was connected up the wrong way round, then raced at the rain ruined Dunsfold Park but showed enough promise to get a Wild Card to the final. The Institute of Materials, Minerals and Mining prize for the innovative use of materials was awarded to 'Carbon Comet' from Ripon Grammar School', left.

Well done to everyone who got the final and here's looking forward to seeing you all back again next year.

*This report on the very exciting final was written by Barry Shears.*

For information on the 2007 Greenpower Electric Car competition visit [www.greenpower.co.uk](http://www.greenpower.co.uk) or contact [info@greenpower.co.uk](mailto:info@greenpower.co.uk)

# GIANT LEAPS

## The Sun and the Science Museum join forces for a bold, entertaining and informative look at Science's greatest discoveries

The Science Museum and *The Sun* newspaper have formed a unique partnership to produce an innovative and fun-filled book presenting the greatest developments in the history of science. *Giant Leaps*, published by Macmillan, combines *The Sun's* genius for headline writing and sharp, snappy copy with the Museum's peerless expertise and popular approach to explaining science. This joint venture aims to make science – seen by many as elitist and unapproachable – exciting and accessible to all by presenting each landmark breakthrough as the front-page news it would have made at the time. The book is written by award-winning Sun journalist John Perry and the Science Museum's Jack Challoner, who has written many science books for both children and adults.



Jon Tucker, Head of the Science Museum, said: “*Giant Leaps* is yet another way in which the Science Museum is doing its utmost to interest and excite people in science and technology. This is what we do every single day at the Museum. Well over two million people a year visit us for free to enjoy our peerless collection of objects, our world-class methods of interpretation, science shows, drama characters and ever-changing series of exhibitions and events. This book is yet another way of exciting new audiences who may not feel the Science Museum is a natural place for them to visit. We hope *Giant Leaps* will go a little way to show that science can be fun.”

*Sun* editor Rebekah Wade said: “Science can make for great newspaper stories and front pages. Dramatic discoveries which had enormous consequences for mankind are presented in *Giant Leaps* in an instantly entertaining and accessible way. Science is an immensely important and fascinating field but at present is failing to excite schoolchildren. We hope kids and adults alike have their interest in science ignited by *Giant Leaps* and that schools all over Britain see the book's merits.”

*Giant Leaps* is the perfect book for everyone who wishes they knew more about science's greatest breakthroughs. Great fun, but packed with facts, each subject is explained across a double page spread.

On each right-hand page is a Sun “front page” showing how the news might have been covered at the time, with headlines such as “Planet Girth” – the measurement of the Earth's circumference by the ancient Greek mathematician Eratosthenes; “Monkey Nutter” – scepticism over Darwin's Origin of the Species; and “Mass Hysteria” – Einstein's  $E=mc^2$  formula. The text is written in *The Sun's* inimitably punchy and knockabout style. The left-hand page accompanying each one gives the Science Museum's knowledgeable overview, with images, graphics and useful tables to make even the most complicated discoveries and theories easy to understand.

Great breakthroughs covered include:

- The Big Bang
- The achievements of da Vinci, Newton and Einstein
- The discovery of vaccination by Edward Jenner
- Faraday's invention of the electric motor
- X-rays, penicillin and DNA
- Concept of the atom
- Quantum theory
- The internet revolution



The book is available to buy in the Science Museum's Store, from its online store [www.sciencemuseumstore.com](http://www.sciencemuseumstore.com) and all good bookshops, priced £12.99

*Ed: I've had a look at this book and it really is a fun and fascinating read - so much so that I added it to my Christmas list to Santa! It describes some life changing discoveries in a really accessible way and I think would be a great way of introducing topics such as evolution for class discussion. I particularly liked the section on the invention of the bread slicer which led to the phrase 'The best thing since sliced bread' (whereas it should actually be 'The best thing since slicing and packing bread' as it was the packing stage that revolutionized the process!).*

# CALCIUM

Calcium (atomic number 20 and atomic mass 40.078) is the fifth most abundant element and third most abundant metal in the Earth's crust at 3% by weight and I'm sure you too remember the adverts on the telly years ago telling us something-or-other (can't remember what) was 'Calci-yummy', but what else do you know about this element which is crucial for our health? Here are a few interesting facts.



- ❖ Calcium melts at 842°C, boils at 1484°C and has a density of 1.55 gcm<sup>-3</sup>.
- ❖ It is a soft grey alkaline earth metal with a face centred cubic crystal structure.
- ❖ In air calcium burns with a yellow-red flame forming calcium nitride. A coating of this white compound is also formed on exposure to air. This surface layer prevents further reaction. A displacement reaction occurs between calcium

and water forming calcium hydroxide:  $2\text{Ca} + 2\text{H}_2\text{O} \rightarrow 2\text{Ca}(\text{OH})_2$

❖ Calcium is not normally found in its elemental state in nature but it occurs as a number of compounds in rocks. In sedimentary rocks it occurs in calcite, gypsum and dolomite and in igneous and metamorphic rocks such as garnets and amphiboles.

❖ Calcium is a major constituent of bones, teeth and shells. Compressed crushed shells from millions of years ago now form the basis of marble, chalk and limestone, where the calcium is present as calcium carbonate..

❖ The word calcium originates from the Latin word *Calx* which means lime or limestone. In the first century Romans were preparing lime as calcium oxide.

❖ It was first isolated by Sir Humphrey Davy in 1808 by electrolysing a mixture of lime and mercuric oxide.

❖ Calcium is produced commercially by the electrolysis of calcium chloride. The chloride is obtained from the reaction of calcium carbonate with hydrochloric acid or as a by-product of the Solway process for making sodium carbonate.

❖ Quick lime (CaO) is made by heating limestone (CaCO<sub>3</sub>). When water is added to quicklime slaked lime is produced (Ca(OH)<sub>2</sub>). If quick lime is left in air it will absorb carbon dioxide and revert to CaCO<sub>3</sub>

❖ Calcium oxide (lime or quick lime) mixed with sand and water forms mortar or plaster and it is one of the key ingredients of Portland cement.



❖ Calcium is an important constituent of a healthy diet. It is important for the formation, growth and maintenance of bones and teeth. A lack of calcium (hypocalcaemia) can lead to the development of osteoporosis whereas too much calcium (hypercalcaemia) can lead to kidney stones. The body needs vitamin D to absorb calcium. Rich sources of dietary calcium include dairy products, nuts, seeds and some green vegetables.

❖ Calcium is also needed for nerve function, muscle contraction and blood clotting.

❖ Calcium phosphate (Ca<sub>10</sub>(PO<sub>4</sub>)<sub>6</sub>OH<sub>2</sub>) or hydroxyapatite forms the mineral constituent of bones. It forms precipitates on a network of collagen fibres. Hydroxyapatite is now being used as a biomaterial in medical implants to reduce rejection and form resorbable grafts on to which broken bones will grow. One of the earliest uses of calcium compounds to aid the repair of body parts is in 600AD. Evidence has been found of dental implants made from Mother of Pearl which have fully integrated with the jaw bone. The calcium carbonate in the Mother of Pearl converted fully to hydroxyapatite!

❖ Calcium is also used as to deoxidise, decarbonise and desulphurise some ferrous and non-ferrous alloys. It is used as an alloying addition in the production of some alloys of aluminium, magnesium, copper, lead and beryllium. Calcium compounds are soluble in water and the precipitation of these leads to the scaling up of pipes, kettles and washing machines in hard water areas.

This newsletter is written and edited by Dr Diane Talbot, Education Co-ordinator.  
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