schools affiliate scheme

news

Issue 43

Summer Term 2013

In this issue:

CONNECTING TEACHERS TO THE WORLD OF MATERIALS, MINERALS AND MINING

WE'RE ON THE HOME STRAIGHT!

Hello and welcome to the final newsletter of this academic year. I don't know about you but I am certainly ready for the summer holidays already and this term is shaping up to be one of the busiest for a long time!

I will be out and about visiting schools and talking to groups of teachers on conferences all over the country. It will be nice to meet some of you for the first time and catch up with some old friends. There is a round-up of upcoming conferences and events on pages 2, 3 and 4.

As some of you may know we have had a good relationship with the Worshipful Company of Armourers and Brasiers for many years. We have been asked to set up and run their new and exciting annual competition for schools. The new Armourers and Brasiers Tata Sixth Form Materials Prize will run for the first time during 2013-2014 and will be awarded in December 2014. Find out more about how you can get involved on page 5.

The SAS news section contains the usual round-up of what's going on and in this issue we have an interesting article on grain-oriented steels for power applications. The poster is on a childhood favourite, the pink wafer biscuit and the element focus on osmium.

It only remains for me to say thank you for your continued support throughout this year and I hope you have a great summer!

The Institute of Materials, Minerals and Mining

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

AUTUMN OPEN DAY PROGRAMME 2013

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

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

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

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

This year the following events will be taking place:

VENUE	MAX NUMBER	DATES AVAILABLE (TIME OF SESSION)
University of Birmingham	30	06, 13, 20, 27 Nov (1400 to 1630)
Edinburgh Napier University	40	06 Nov (1230 to 1530)
University of Leeds	40	09, 16, 23, 30 Nov, 06, 13 Dec (1230 to 1600)
University of Loughborough	15	05, 07 Nov (1300 to 1530)
University of Manchester	25	06, 13, 20, 27 Nov (1400 to 1600)
University of Oxford	20	12 Nov 1030 to 1500
University of Sheffield	20	21, 28 Nov (1300 to 1500)
University of Swansea	35	20 Nov 1230 to 1530

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

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

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

Typical activities

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

Typical activities include:

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

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

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

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

BIOMATERIALS – Bionic Man, Fact Or Fiction?

The Boilerhouse, Grantham
Thursday 04 July 2013

The latest in our series of conferences for teachers will be taking place here at The Boilerhouse in early July. The theme for the event is Biomaterials as this is always an area that excites and intrigues students and teachers alike when I give talks in schools. It is also a field which is growing and one in which there are many career opportunities.

This programme has been put together to give you an overview of this exciting and thriving area of materials. It will give you contexts that you can use in your teaching and careers ideas that you can pass on to your students.

The day will start with the keynote lecture, given by Professor Serena Best who has lectured on this topic to a wide range of audiences all over the world. The technical presentations, given by other experts in their field will cover a range of biomedical devices. Immediately before lunch you will have the chance to ask questions to all of the speakers, either on their individual presentations or the subject matter in general.

After lunch there will be a group discussion session in which you will look at how you can use the things you have learnt back in the classroom and a quick look at some new resources from IOM3. Once the obligatory feedback forms have been completed the course will close at approximately 1530.

The draft programme is as follows:

0915	Arrival and registration	
0945	Welcome and introduction	Dr Diane Aston
1000	An introduction to Biomaterials	Prof Serena Best
1045	Total joint replacements	Karen McInlay
1115	Bone substitute materials	Dr Irene Turner
1145	Comfort break	
1200	Dental materials	Dr John Nicholson
1230	Tissue engineering	Dr Julian Jones
1300	Open Q&A, including careers	All speakers
1330	Lunch, exhibition and chance to meet students	
1415	Using what you have learnt back in the classroom	Dr Diane Aston
1500	New resources from IOM3	Dr Diane Aston
1515	Feedback and refreshments	Dr Diane Aston
1530	Close	

For more information about this event please email diane.aston@iom3.org.

The Biomedical Applications Division
of the Institute of Materials, Minerals and Mining

We are really pleased that our Biomaterials Conference is being supported by the Institute's Biomedical Applications Division.

Registration

This conference is open to all science and design technology teachers and places are not limited to one teacher per school. Registration is on a first come first served basis and there are 20 places available.

The registration fee to attend this conference is £50, which contributes towards the cost of administration. **The closing date for registrations is Friday 21 June 2013.**

One or two places on the conference are included in the SAS Premier and Premier Plus membership packages respectively. For more information about the Schools Affiliate Scheme please visit www.iom3.org/sas.

CONFERENCE REMINDER!

The summer term is typically a very busy time for teacher conferences. Just a quick reminder of the courses that we are involved in as there are still places available...

Polymer Study Tours

When:	23 to 26 June 30 June to 03 July 07 to 10 July
Where:	Edinburgh Napier University London Metropolitan University Manchester University
Cost:	Free (£50 refunable deposit to secure your place)
Subject:	Chemistry and D&T
Level:	KS3, KS4, A-level or equivalents
What's included?	All accommodation, meals, refreshments and transport between venues
Further info	www.iom3.org/content/pst or email diane.aston@iom3.org
Why should I attend	Interesting, intensive, relevant, networking, subject knowledge, experience industry, polymers

These courses are now in their 27th season and for good reason! Attending a Polymer Study Tour gives you far more than just finding out everything you ever needed to know about plastics!

The Tours give you the chance to meet experts from industry, experience great UK manufacturing first hand and have the time to network with like-minded colleagues from around the country. The four day duration of the course allows you to build strong relationships with the rest of the group and the course leaders and gives you time to ask those probing questions that you have always wanted answers to!

The Tours are fully sponsored by the Worshipful Company of Horners and companies operating the polymer industry and are supported by the British Plastics Federation, IOM3 and participating universities.

Rolls Royce Materials Masterclass

When:	09 to10 July
Where:	University of Birmingham and Rolls Royce, Derby
Cost:	£50
Subject:	Phyusics, Chemistry, D&T
Level:	KS4, A-level and equivalent
What's included	All accommodation, meals, refreshments and transport between venues
Further info	www.slcs.ac.uk/westmidlands/44309 or email enquiries@slcwm.keele.ac.uk
Why should I attend	High end manufacturing, all materials, subject knowledge, relevant, careers, exciting!

This course has been running since 2000 and has recently undergone a transformation into the current two-day format. This course is packed with useful contexts for teaching materials in schools and shows how topics in science and technology can be linked with a common theme.

Aerospace is an exciting industry and jet engine engineering features some exceptional materials being used in mind-blowing conditions. The works visit is like nothing you have seen before and the university lectures and lab classes back up the industrial experience with solid subject knowledge enhancement.

This course comes very highly recommended and is sponsored by Rolls Royce and the Worshipful Company of Armourers and Brasiers and is supported by the West Midlands Science Learning Centre, University of Birmingham and IOM3.

NEW COMPETITION FROM THE ARMOURERS AND BRASIERS COMPANY

This is a new competition designed to support schools in encouraging students to develop a sustained interest in STEM careers. It has been setup to give students structured opportunities to find out more about Materials Science and Engineering and enhance and enrich their studies.

The Prize is a stand-alone project that is carried out by year 12 students during one school year.

What are the prizes?

The winning students and their schools will receive prizes as follows:

	Student	School
First prize	£1500	£1000 and IOM3 SAS membership
Second prize	£750	£500 and IOM3 SAS membership
Best portfolio prize	£500	£500 and IOM3 SAS membership
3 runners up	£250 each	IOM3 SAS membership*

TATA STEEL

Who is eligible to enter?

The competition is open to year 12 students studying at least one post-16 course in a STEM subject (i.e. physics, chemistry, design technology, engineering and maths). The students must make a commitment to engaging with the project throughout year 12, devoting a minimum time of around 18 hours to learning more about materials.

How does the Prize work?

Participating students compile a Portfolio of Experiences based on six short modules that are completed outside normal lessons with the guidance of their teachers. The modules are designed to give students a better understanding of the importance of materials science and engineering in society and some knowledge of the fundamental science of materials, enhancing what they might study in their lessons. The themes of the six modules are as follows:

1. What is Materials Science and Engineering?
2. Materials around us
3. The future is materials
4. Fuelling the future
5. Where can materials take me?
6. Individual research project

The modules comprise three activities, each taking approximately one hour to complete and the aim is to complete one module every half term. The students collect the results of their research and

experimentation in their portfolio and should be encouraged to build up a collection of useful articles and reports relating to other 'materials experiences' that they have had. As part of Module Six students must also prepare a five minute presentation which they will deliver to their peers.

The prize has been designed so that the six modules can be guided by either science or design technology teachers, although in an ideal world the two departments would work together as materials is such a multidisciplinary subject.

A full pack of support materials will be provided for teachers, including detailed notes, handouts and ideas for activities which can all be done with everyday materials and equipment that most schools already have.

How will the Prize be judged?

In June 2014 teachers in participating schools will assess the portfolios and presentations of their students and nominate a maximum of five candidates from each school for the next round of judging. The portfolios of the nominated candidates, accompanied by an official entry form, should be sent to IOM3 by the closing date, Friday 04 July 2014.
Six finalists will be chosen from all the submitted portfolios and they will be notified by the end of September 2014. The finalists will be invited to give their presentations at Armourers' Hall in London in early December and the winner will be chosen from these on the basis of their presentation and portfolio.

How do we enter?

If you would like to participate in the competition during the 2013-2014 academic year you will need to register your school. You can do this by completing and submitting the form at www.iom3.org/A&B-TataPrize. Once we have received your registration you will be issued with a login and PIN so that you can access and download all the course materials that you will need for your school to participate in the competition. The **closing date for school registrations** is **Friday 05 July 2013**.

Once your students have completed the six modules you should nominate a maximum of five entrants for the final round of judging based on their portfolio and presentation. With your help, these students should submit their portfolio accompanied by an official entry form. The **closing date for entries** is **Friday 04 July 2014**.

How can we find out more?

Full details of the Armourers & Brasiers Tata Sixth Form Materials Prize are available at www.iom3.org/A&B-TataPrize. Alternatively you can contact Dr Diane Aston on 01476 513882 or by emailing diane.aston@iom3.org.

Who are the Armourers and Brasiers' Company?

The Worshipful Company of Armourers and Brasiers, to give them their full title, is one of the Livery Companies of the City of London and with roots as a Craft Guild dating back to 1322.

As there is not too much demand for armour today the Company now directs is charitable giving to supporting materials science projects from primary school grants right through to the Venture Prize which supports the commercialisation of promising materials research.

The Company supports activities offered by a number of other organisations designed to raise awareness and reward achievement in materials. They currently sponsor materials content on courses for teachers organised by IOM3, the Institute of Physics, the Royal Society of Chemistry, the Royal Society and courses for school pupils organised by the Salters' Institute.

For more information about the Company and how they can help to support your materials teaching in school please visit www.armourershall.co.uk/materials-science.

SAS NEWS

As we are rapidly approaching the end of another year it is time to reflect on the highs and lows of the past couple of terms. We seem to be as busy as ever and it is lovely to see that membership of the Schools Affiliate Scheme is continuing to grow steadily.

There has not been much uptake of the new paying membership grades and we wondered if you would be able to take a minute to let us know why. We have tried to price these two grades at a cost commensurate with the resources that you are guaranteed access to so as a reminder Premier Members get a box for two weeks (rather than the one week offered to Standard members) and one place on our annual conference for £150 per year and Premier Plus get a box for four weeks, a visit to give two talks and two places on our annual conference for £500 per annum.

Schools on the whole do still seem happy to pay the £150 or £200 for me to come and visit, so is the difficulty showing your budget controlled the benefits of purchasing membership rather than a tangible resource or is it just that the prices are simply too high? Please let us know your thoughts by emailing diane.aston@iom3.org with SAS membership in the subject line.

The Discovery Boxes have been received well by all that have borrowed them so far and there has been a pleasing take-up despite publicity being minimal. Over the summer we will be developing a further 18 boxes, making 28 in total. If you would like to know more about the boxes, their contents and how you can use them please get in touch!

We are starting to think of ideas for the SAS annual resource for 2013-2014 and indeed 2014-2015. If you have any ideas for electronic resources that we can develop on areas of the curriculum which you think are currently under supported please get in touch.

We are also starting to think about the conference for 2014 so are there any topics you would like to see covered here. Should we try opening the event out to teachers and sixth form students, would you like something with careers focus? Again, please let us know your thoughts.

Over the coming months we will be piloting our project for primary schools with the aim of launching it in nationwide in early 2014. This is something that we envisage you being able to use with your feeder primaries during transition so do watch this space for more information!

Diane's Diary

At a recent meeting someone asked if I could start including my diary of planned visits again so that you can see when there is availability.

Here we go for the summer term...

Date	Visiting
19/04	St Albans School
26/04	Moray House, Edinburgh
07/05	Univ of Worcester
14/05	Sibford School, Banbury
16/05	QEGS, Penrith
06/06	IOP Rugby Meeting
07/06	Marlborough College
12/06	Teach First, London
23/06	Edinburgh Napier PST
24/06	Brighton Salters' Camp
26/06	Brighton Salters' Camp
30/06	London Met PST
06/07	IOP Stimulating Physics @ Charterhouse
08/07	Manchester PST
08/07	Bath Salters' Camp
09/07	RR Materials Master Class
10/07	Bath Salters' Camp
23/07	Manchester Salters' Camp
25/07	Manchester Salters' Camp

I am already taking bookings for the autumn term. If you would like me to come and talk to your students please get in touch by emailing diane.aston@iom3.org or calling 01476 513882

START SAVING ON YOUR ENERGY AT POWER SOURCE

When buying a domestic appliance one of the selection criteria for us is its energy rating. But do you ever think about the efficiency of generating and distributing the electricity that powers it?

Transformers are devices that 'step up' and 'step down' the voltage of an electricity supply; they are used to facilitate the generation, transmission and distribution of electricity for domestic or industrial applications.

Layers of electrical steel are stacked to build transformer cores which form strong electromagnets when AC current is applied. They are extremely efficient and minimise the use of expensive copper. Grain-oriented electrical steels have their best magnetic properties in one direction; this attribute is used to build powerful and efficient transformer cores.

My objective is to make the grain-oriented steel used to build transformers easier to magnetise in an electric field and maximise useful energy produced, while minimising wasted heat due to magnetic core losses.

Despite complaining about electricity prices, few of us are willing to give up our addiction to portable electronic devices (all requiring regular charging), home entertainment systems or games consoles. Electrical power generation, transmission and distribution can be made more efficient by developing grain-oriented steels with better magnetic properties, helping to keep electricity affordable and reducing environmental impact.

For transformers to have high energy efficiency, low losses and low noise (the distinctive transformer 'hum') the magnetic properties of the grain-oriented steel used in them must be carefully controlled. They need to have a high permeability which means they are easy to magnetise and demagnetise in an alternating electric current.

High levels of silicon added during steelmaking reduce the magnetic losses in the final product, although this makes the steel brittle and difficult to roll. So it is a balancing act between the practical aspects of manufacturing and reducing magnetic loss.

The purpose of my research is to develop electrical steels with low magnetic losses, that are easy to magnetise and with a very thin strip thickness which can be consistently manufactured.

The production process has several heat treatment and rolling steps and takes about two weeks from start to finish, when the magnetic properties can finally be measured. Each production step impacts on the next and this, together with steel chemistry affects the magnetic quality of the final product. This is particularly evident for thinner steel strip. The objective of my research is to develop a repeatable recipe for the industrial production of very thin grain-oriented steel strip with low magnetic losses by identifying, understanding and controlling steel chemistry and the parameters at each processing stage.

Fiona Robinson is principal researcher at Cogent Power Ltd, Tata Steel and her work is focussed on improving the magnetic properties of grain oriented electrical steels primarily for use in transformers.

For more information you can contact Fiona at Fiona.cj.robinson@tatasteel.com

This article first appeared in Wales Online on 11 February 2013.

Grain-oriented electrical steel is a long established but continuously evolving product. Customers want to construct increasingly efficient transformers. This necessitates research to reduce magnetic losses, making magnetisation easier, and roll brittle high silicon steels even thinner.

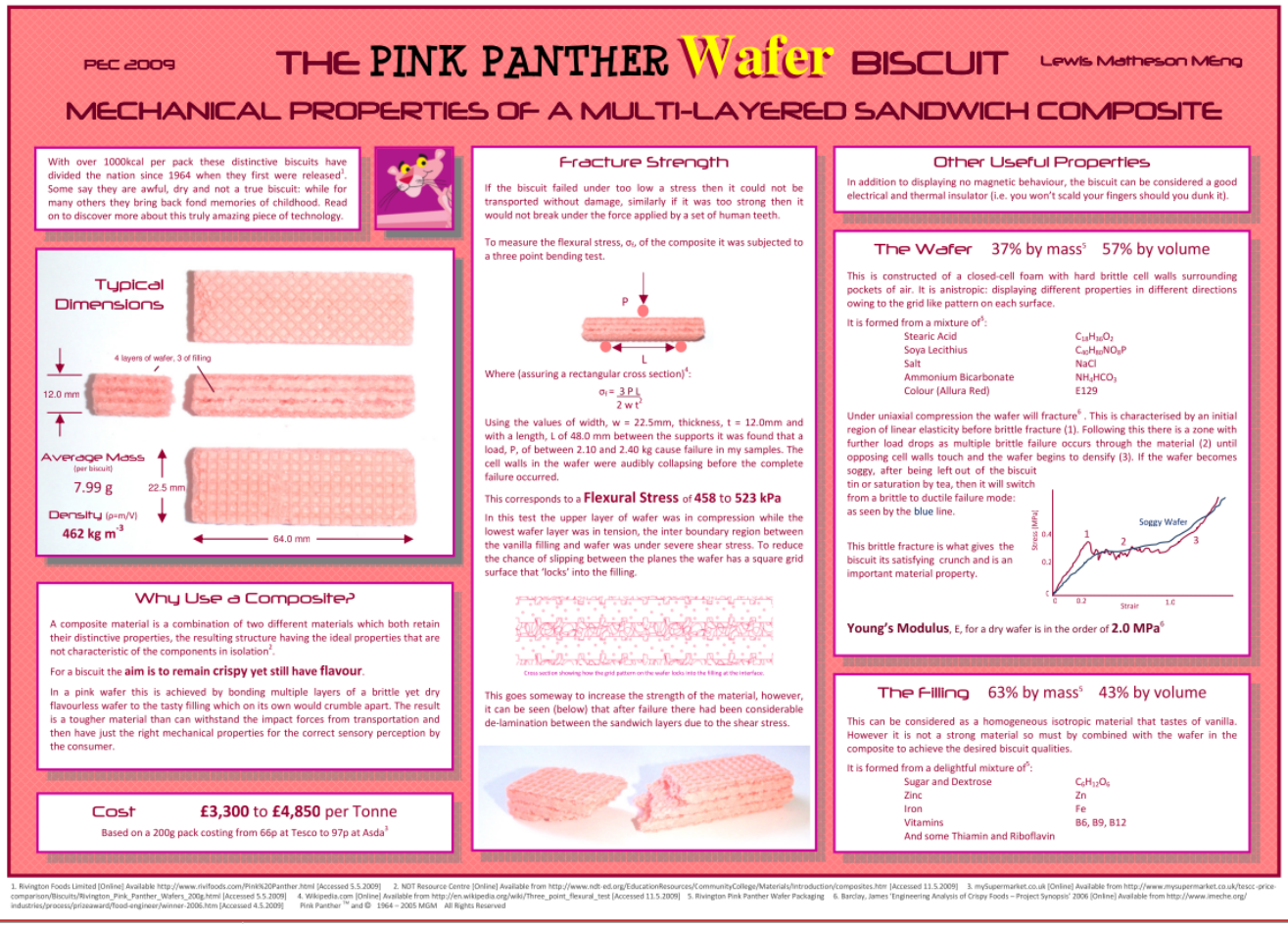
The practical application of academic theory can be difficult as every production facility is different and has been updated as new technology becomes available.

By further improving the magnetic properties of grain-oriented electrical steels we can maintain manufacturing of this high quality product in Wales.

MATERIALS POSTERS FOR SCHOOLS III

The two posters in the previous issues have been on pretty conventional materials; diamonds and titanium are used extensively in structural applications all around us. The final poster in this series is on a truly innovative material and considers the mechanical properties of a well-loved childhood favourite. We hope you enjoy!

PINK WAFER BISCUITS



This poster describes the structure of the pink wafer biscuit as a composite material and goes on to demonstrate how the material behaves during a three point bend and uniaxial compression test. Luke shows really well how you can use every day, familiar materials to carry out genuine tests and produce some really good results.

I hope that you and your students take inspiration from this and try to do experiments on everyday materials yourselves. Think of other chocolate bars – you can investigate the effect of particulate reinforcement by comparing the extension of a Mars and Snickers, you can look at the effect of temperature on properties by performing simple impact and tensile tests on Cadbury's fudge bars (cooled in the fridge, at room temperature and gently warmed). I'd be fascinated to hear what other ideas you can come up with using different types of chocolate.

The Welding Institute (TWI) has given you a great start with their white chocolate beam welding experiment (http://www.theweldinginstitute.com/fab-futures/educational-outreach/welding-with-chocolate/). Have fun!

OSMIUM

- Osmium has atomic number 76 and atomic mass 190.23. It sits in Group 8 (VIIIB) of the Periodic Table in the third transition series between rhenium and iridium and with ruthenium above and the little known hassium below. It is described as a platinum group metal along with ruthenium, rhodium, palladium, iridium, and platinum.
- Osmium melts at 3045°C and boils at 5012°C. It has the fourth highest melting point of all the elements after carbon (3500°C), tungsten (3410°C) and rhenium (3180°C).
- Osmium also wins the accolade for being the densest element having a density of 22.59gcm^{-3}. However, iridium is very close behind with a density of 22.56g.cm^{-3}!
- Throughout the latter half of the 18th Century numerous notable scientists observed a dark residue when experimenting with platinum. None were able to isolate enough of this new material to analyse it. In 1803 Smithson Tennant did just that and identified two new elements which he named osmium (after the Greek '*osmos*' meaning smell as the osmium tetroxide he produced had an unusual smell) and iridium (named after the Greek goddess of the rainbow *Iris*).
- Osmium is the rarest stable element in the Earth's crust having an abundance of less than 50 parts per million. It occurs in its native form and also in natural alloys, chiefly with iridium. It is primarily found in igneous deposits and impact craters and the largest known reserves are in the Bushveld igneous complex in South Africa and the Ural Mountains in Russia.
- Osmium is produced commercially as a bi-product of nickel and copper extraction. It is collected alongside numerous other precious metals in the 'mud' deposited at the anode during electrorefining. The mud is then processed to liberate the individual constituents including osmium. The estimated annual production of osmium in the US in 2012 was 75kg (or 0.075 tonnes), this compares to 88.7 million tonnes of steel.
- The exceptionally high melting point of osmium means that it cannot be shaped by casting. Rather it is formed as a powder or sponge that can be pressed to shape. Alternatively pure osmium crystals can be grown using chemical vapour deposition.
- Osmium has a relatively dark blue-grey lustrous appearance and is a very hard but brittle metal. It has a hexagonal close packed crystal structure.
- Osmium alloys (particularly with iridium) have been used in applications requiring exceptional wear resistance and durability such as fountain pen nibs, electrical contacts and tips for record player styli.
- Osmium was used as the filament material in early lamps. It was replaced by tungsten in the early 1900s as this was more stable and has a higher melting point.
- Osmium tetroxide can be used to detect fingerprints as it stains fatty tissue.

Osmium is a dark grey-blue metal that retains its lustre to high temperature.. From http://en.wikipedia.org/wiki/File:Osmium_1-crop.jpg

Osmium crystals grown using chemical vapour deposition. From http://en.wikipedia.org/wiki/File:Osmium_cluster.jpg

Osmium alloys have been used for the tips of fountain pen nibs From http://en.wikipedia.org/wiki/File:Fountain-pen-nib.jpg

Where can I find out more?

http://en.wikipedia.org/wiki/Osmium

http://en.wikipedia.org/wiki/Platinum_group_metals#Osmium

http://www.webelements.com/osmium/

http://www.rsc.org/periodic-table/element/76/osmium