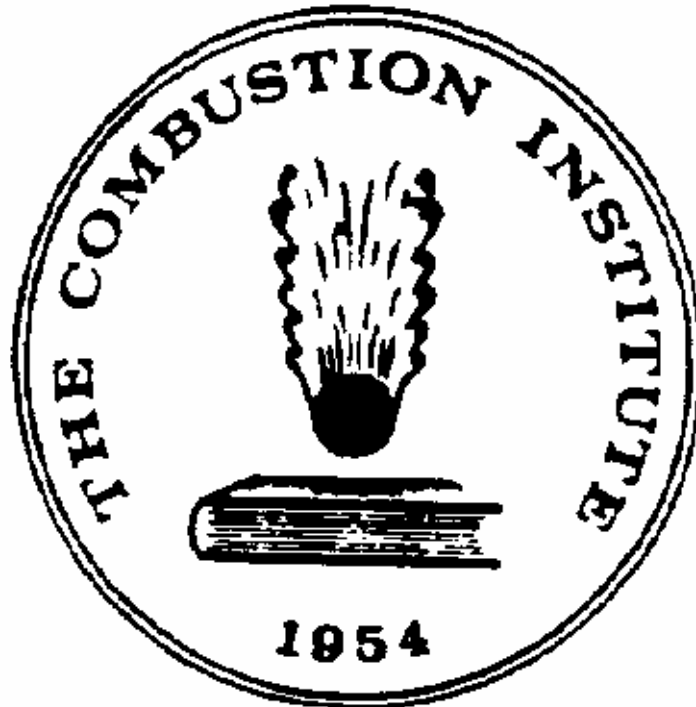


THE COMBUSTION INSTITUTE

(British Section)



NEWSLETTER

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World Wide Web versions of this *Newsletter* at:-
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EDITORIAL

Friends tell me that I should not always apologise for failures.....

So instead, I welcome you to a special and unscheduled Summer Edition of the *Newsletter*; I shall not dwell on the absence of the promised Spring Edition!

The “British Section News” includes some important topics. As a result of a number of changes in the committee membership after the last AGM, we have a new Hon. Secretary and some new members. Alison Tomlin retired as Hon. Secretary to take up an “Advanced EPSRC Five-year Fellowship” and a special award to allow her to spend some time at the Argonne National Laboratory in Chicago (see Newsletter NL 2002-1 for more details). Yajue Wu has taken her place. Yajue will also be dealing with membership matters for a few months while Valerie Dupont takes some leave.

It should also be noted that there will be two vacancies on the committee from this September. Nominations are invited to fill these vacancies. The AGM will be held as part of the IOP meeting in Loughborough on 18 September.

The promised list of 2002 publications by CI(BS) members appears as a “pull-out supplement” in the centre of this *Newsletter*. Let me know if you think this is useful and worth repeating for 2003 publications.

I am very grateful for yet another article by Ken Palmer. The *Newsletter* would not be the same without his contributions. May I appeal, yet again, to readers for their contributions. Is there anyone out there? I am always rather disappointed by the response of readers to the *Newsletter*. I receive praise for each issue, but few offers of articles, letters to the editor or even suggestions for improvements. Please surprise me! I hope to produce an Autumn/Winter edition in November with your help.

The committee has been discussing ways to raise the profile of combustion in Britain. Anyone with suggestions should contact Chris Lawn and/or write a note to me. It is important that the subject is made known to school children and university students as well as politicians and the general public.

You may notice that I have repeated parts of earlier editorials. I make no apologies for continuing.

Despite the efforts of the committee, especially Valerie Dupont, our membership secretary, the number of members has been falling over the last year or so. It is very important to keep up the size of our membership particularly to allow us to support and fight for combustion interests in Britain. Please make an effort to recruit colleagues, your boss, research students, friends and anyone interested in the health of British combustion research and development. The membership fee is very small and the benefits can be large.

Have a great summer.

Tony Burgess

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BRITISH SECTION NEWS

Annual General Meeting of The Combustion Institute (British Section). Nominations for the British Section Committee.

This year the AGM will be held at the Young Researchers Meeting organised by the Combustion Physics Group of the Institute of Physics to be held at Loughborough University on Thursday 18 September 2003. Details of the meeting will be sent out shortly.

There will be two vacancies in the CI(BS) committee to be filled at the AGM. These result from the retirement of Dr M Fairweather and Professor W P Jones from the committee after the end of their term of office.

The Committee is much aware of the need for a balance that reflects different sectors and activities of the combustion community in the UK. Please give thought to this, and make your own views count through a nomination. For each nomination it is necessary to have the support of three ordinary members. Such nominations must be received by the Hon Secretary, Dr Y Wu by 10 August 2003. Each nomination should be accompanied by a brief statement which outlines the background of the candidate regarding his or her appropriateness to be a Committee member. This statement will be included on the ballot paper, in the event of an election being necessary.

The Hinshelwood Prize for Combustion

This is a new annual prize to recognise meritorious work in any branch of combustion by a younger member (under 35 years old) of The British Section of The Combustion Institute. The first prize will be awarded at the end of this year. The British Section Committee will consult heads of departments in UK universities and others for nominations.

New website

The new web site for the Combustion Institute British Section should be available soon. The web address will be:
www.combustion.org.uk

Meanwhile the *Newsletters* will also still appear on the UCL site:
www.chemeng.ucl.ac.uk/research/combustion

Membership Matters

Valerie Dupont, the CI(BS) Membership Secretary will be away for a few months because of other commitments. During this time all membership information should be sent to the new Hon. Secretary, Dr Yujue Wu.

Travel Grant Awards 2003

The CI(BS) Committee have awarded the following travel grants so far this year. Each successful applicant will be required to write a short report on his or her experiences at the meeting for the *Newsletter*.

Applicant	Institute	Conference Details
Ahmed M S Ali	Aeronautical and Automotive Engineering Department, Loughborough University	Third International Symposium on Turbulence and Shear Flow Phenomena (TSFP-2003). Sendai, Japan, 25-27 June 2003. Paper titled "Two- versus Three-Dimensional LES of Premixed Turbulent".
Nazar Abdelkarim	Aeronautical and Automotive Engineering Department, Loughborough University	9th International Conference on Liquid Atomization and Spray Systems (ICLASS 2003). Sorrento, Italy, 13-18 July 2003. Paper titled "An Evaluation of Three Atomisation Models for Dense Sprays".
Amit Bhawe	Department of Chemical Engineering, University of Cambridge	ASME Conference, Austria, 12 May 2003. Paper titled "Analysis of the HCCI combustion of a Turbocharged Engine using a stochastic reactor model".
Gavin Rickett	Department of Fuel and Energy, School of Process, Environmental and Materials Engineering, University of Leeds	Seventh International Conference on Energy for a Clean Environment (Clean Air 2003), Lisbon, Portugal, 7-10 July. Paper titled "CH ₄ , H ₂ S and SO ₂ oxidation on Pt catalysts"
Leonardo Paes Rangel	Department of Fuel and Energy, School of Process, Environmental and Materials Engineering, University of Leeds	Seventh International Conference on Energy for a Clean Environment (Clean Air 2003), Lisbon, Portugal, 7-10 July. Paper titled "Experimental Investigations of Counter-Flow Double Flames Applicable to an Industrial Natural Gas Burner"
Ian Hanley	Department of Fuel and Energy, School of Process, Environmental and Materials Engineering, University of Leeds	1st European Hydrogen Energy Conference, Grenoble, France, 2-5 September 2003. Poster titled "Development of Un-Mixed Reforming for Production of Hydrogen from Vegetable Oil".

If you have an interest in any combustion-related topic you should join

THE BRITISH SECTION OF THE COMBUSTION INSTITUTE

For a very small fee there are many benefits:-

- substantial travel grants to Combustion Symposia & other meetings
- reduced fees at Section-sponsored meetings
- free on-line access to *Combustion and Flame*
- reduced subscriptions to several combustion journals
- the Section's *Newsletter*
- and a chance to meet like-minded people

Ask the Hon Secretary, Yajue Wu, for details.

E-mail: <y.wu@sheffield.ac.uk>

All members are urged to try to recruit their colleagues, students, friends and even their bosses! We need a large membership to ensure that the voice of combustion is heard in Britain.

THIRTIETH INTERNATIONAL SYMPOSIUM ON COMBUSTION

To be held at the University of Illinois at Chicago, USA from 25-30 JULY 2004

The Thirtieth International Symposium on Combustion will be held during the week of 25-30 July 2004 at the University of Illinois at Chicago. Scientists, engineers and others interested in combustion are invited to attend and participate in this biennial event.

PROGRAM COMMITTEE CO-CHAIRS:

Ronald K Hanson, Stanford University, Stanford, CA USA

R Peter Lindstedt, Imperial College, London, UK

COLLOQUIA:

Reaction Kinetics

Pollutant Formation

Diagnostics and Sensors

Laminar Flames

Turbulent Flames

Heterogeneous Combustion

Detonations, Explosions & Supersonic Combustion

Fire Research

Stationary Power Systems & Environmental Mitigation

Propulsion & Engines Combustion

Material Synthesis & Catalysis

New Technology Concepts

SUBMISSION DATES AND INSTRUCTIONS FOR PAPER AND POSTER SUBMISSION:

Date for receipt of completed paper: December 1 2003

Instructions on submission of papers see: <http://combustioninstitute.org/30sym.html>

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Date for receipt of abstracts for Work-in-Progress Posters: April 14 2004

Instructions on submission of wipp see: <http://combustioninstitute.org/30thwipp.html>

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LOCATION AND TRAVEL: Chicago is in the central United States and situated on the western shore of Lake Michigan. It has easy access by air or land. O'Hare International Airport has direct flights to and from all major cities in Europe and Asia, as well as those in the US. Chicago is also served by Midway Airport, which handles additional domestic

flights and limited international flights. Both airports have subway, taxicab, and shuttle bus service to downtown, which takes approximately 25-40 minutes depending on the mode of transportation and time of day. Chicago's climate is typical for mid-America. The average daytime temperature in late July is 78-82°F (25-28°C), but can reach into the 90s°F (30s°C).

LOCAL ARRANGEMENTS: The main site of the Symposium is the campus of the University of Illinois at Chicago (UIC). This is adjacent to downtown and has convenient access by public transportation to other areas of interest in the city. Many attractions are a 15-20 minute walk from campus.

The Symposium will open with a Welcome Reception at the UIC Chicago Circle Center. The opening ceremony and Hottel Lecture will be held at the UIC Pavilion. Technical sessions will be held on campus. The Wednesday afternoon picnic, culminating with evening fireworks, will be held at Navy Pier on Lake Michigan. The Banquet will be held on Thursday at the Fairmont Hotel. The Farewell Reception will be held in the Lecture Center Plaza.

Chicago is one of the liveliest cities in the US and the world's convention capital. It has an abundance of events, attractions, world class dining and shopping, plus great hospitality. Over 30 million domestic and international travelers visit the city each year. Local tours are planned.

ACCOMMODATION: The Fairmont Hotel is planned as the main Symposium hotel. Other hotel and accommodation arrangements include the Hotel Inter-Continental, the Holiday Inn Chicago City Centre, the Holiday Inn Hotel and Suites Downtown Chicago, and the university dormitories. Additional information will be forthcoming on the website.

For additional Information see: www.engr.uic.edu/combustion2004

CURRENT RESEARCH IN COMBUSTION:

A Forum for Research Students and Young Researchers

Notice of a one-day meeting of the Combustion Physics Group of the Institute of Physics to be held at Loughborough University on Thursday 18 September 2003

The AGM of the British Section of the Combustion Institute will also be held at this meeting

The Institute of Physics Combustion Physics Group will be holding a one-day meeting for young researchers at Loughborough University on Thursday 18 September 2003. The meeting will provide a forum for researchers in any topic relevant to combustion, with up to five years experience in University or Industry, and the opportunity to meet other researchers and industrialists. The meeting will be sponsored by the EPSRC and industry and will provide industrialists with a broad view of current combustion research and a chance to meet potential recruits in the field.

Current work performed by young researchers will be presented either orally or by poster. The best oral presentation will be awarded the Weinberg prize, there will also be a prize for the best poster presentation with additional prizes for the runners up in both oral and poster presentations.

More details from either:

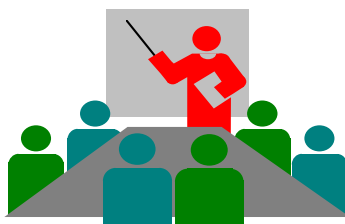
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Details of the AGM of the Combustion Institute (British Section) which will be held during this meeting may be obtained from the Hon. Secretary:-

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AUTOIGNITION

Report on the Spring meeting of the Combustion Institute (British Section) held on Wednesday 16 April 2003 at the University of Oxford

A one-day meeting on "Autoignition" was held in the Department of Engineering Science at Oxford on 14 April 2003. The organisers were Gautam Kalghatgi and Richard Stone. Sixty- five people including delegates from Sweden, France, Netherlands, Portugal and Spain attended. Many delegates took advantage of the amazingly cheap rate arranged by Richard Stone and stayed overnight at Somerville College. So on the night of the 13 April combustion folk could be seen moving in large groups from pub to pub seeking food!

There were eight invited talks covering different aspects of autoignition. The meeting ended with a summary by Prof. Simone Hochgreb of Cambridge University and a very lively discussion, mostly on the merits or otherwise of empirical approaches to study autoignition.

Abstracts of Talks (provided by the authors before the meeting)

Fundamentals of Autoignition Chemistry

John Griffiths, Leeds University.

The dependence of heat release on temperature for different n-butane + air mixtures, derived numerically over the range 600-900 K, will be shown. Links to cool flame and two-stage ignition behaviour in a non-isothermal closed vessel will then be made. The activity at different temperatures will be interpreted in terms of key components of the kinetics and mechanisms for alkane oxidation. Quantitative aspects will be discussed and illustrated through the contrasting behaviour of n-butane and i-butane. The thermokinetic models have been generated automatically, using THERM and EXGAS, by colleagues at CNRS-DCPR, Nancy. They comprise approximately 150 species involved in 1250 reactions

Autoignition in Spark Ignition and Diesel Engines

Chris Morley, Ex Shell Global Solutions.

Aspects of how autoignition is manifested in both types of engine are discussed. With respect to gasoline engine knock these include: its necessity in well-designed engines; the generation of high pressures and the relation to damage; and the importance of deposits and the mechanisms by which they induce knock. The conceptual understanding of diesel combustion has been considerably enhanced in recent years by the insights of John Dec and coworkers. Their model is that almost all the fuel (and not just that in the "premixed" phase of combustion) is consumed in a rich autoignition front. Its implications for particulate emissions of fuel composition and ignition quality are considered.

Controlled Autoignition (CAI) Combustion Engines,

H Zhao, Brunel University.

Controlled Auto-Ignition (CAI) combustion represents a radical change from the conventional engine-combustion processes encountered in the spark-ignition gasoline and compression-ignition diesel engines. The presentation will start with a brief introduction to the CAI combustion process and characteristics of the new combustion process. The effect of engine parameters and fuel properties on the CAI combustion process will then be discussed. Finally, the results from a production-type multi-cylinder gasoline engine running with CAI combustion will be presented.

Autoignition in HCCI Engines

B Johansson, Lundt University, Sweden.

The homogeneous charge compression ignition, HCCI, combustion process is relatively new compared to the conventional spark ignition, SI and compression ignition, CI combustion processes. Thus there has been less time for researchers around the world to study the process in detail.

Some early application of laser diagnostics at Lund University is presented. From conventional planar laser-induced fluorescence, PLIF imaging of fuel or OH it was concluded that the combustion process is very heterogeneous in nature even though fuel concentration is homogeneous. The large structures seen could be the result of local flame propagation but from one single image per cycle that cannot be determined. To study the evolution of the combustion process a single cycle must be captured due to the large random cycle to cycle variations. Fuel-PLIF was applied with a unique multi-YAG system to capture 8 frames in one cycle. This number was sufficient to see that the combustion process started rather uniformly, but as time progress more and more structures can be seen. This is explained by the "local positive feedback" experienced between temperature and reaction rate, amplifying even the smallest variations in temperature.

Autoignition quality of practical fuels in internal combustion engines

Gautam Kalghatgi, Shell Global Solutions.

Diesel engines and Homogeneous Charge Compression Ignition (HCCI) engines rely on autoignition for the initiation of combustion while in spark ignition (SI) engines autoignition leads to knock, which is a major constraint on efficiency and power. The talk will consider the case where fuel and air are premixed as in the HCCI or SI engine and use results from an HCCI engine for illustration. Practical fuels used in such engines are complex mixtures of hydrocarbons whose autoignition chemistry is not understood in detail. The autoignition quality of such a fuel has to be defined using an empirical approach. It can be best described by an Octane Index, OI defined as $OI = (1-K)RON + K MON$ where RON and MON are the Research and Motor octane numbers respectively of the fuel while K depends only on engine design and operating conditions. The larger the OI, the greater is the resistance to autoignition. The RON and MON of any fuel can be determined by standard procedures that are based on comparing the fuel to mixtures of the two paraffinic fuels *iso*-octane and *n*-heptane for knocking behaviour in a single cylinder test engine. The value of K is found empirically by ranking fuels of different chemistry for their autoignition behaviour at a given operating condition. K can vary widely and can be negative or greater than unity depending on the pressure/temperature history of the fuel/air mixture. However K does not vary randomly but depends strongly on generic engine parameters such as the compression temperature at a fixed pressure in the engine and can be estimated from empirical results if such parameters can be predicted.

Autoignition and its effect on Practical Gas Turbine Combustion Systems.

John Moran, Rolls Royce.

In a continuous combustion process the ability to use the autoignition phenomenon is to the designers advantage. This is done by the use of creating recirculation regions within the combustion space to ensure that both the residence time increased and that contact with higher energy species occurs. However the drive to ever lower NO_x emissions from gas turbine combustion systems has introduced a severe problem in controlling the onset of autoignition. The preferred method adopted in the gas turbine industry for achieving low emission combustion is lean premixed technology. The use of this technology requires

that the combustion designer have a good knowledge of the autoignition characteristics of the fuels being used. Without adequate knowledge of the autoignition characteristics of the fuel and the operating conditions catastrophic failure of the component can occur. This failure is not acceptable on land-based machines due to the cost of replacement parts and reliability. Similarly it is totally unacceptable on aero machines from an airworthiness point of view

The autoignition properties of gas turbine fuels both liquid and gas have been studied for many years and by numerous researchers. Lean premixed technologies have given rise to pre-mixer designs, which may not be optimal with longer residence times. This, in conjunction with the ever-increasing pressure ratios of aeroderivative machines, leads to the potential for autoignition within pre-mix ducts, and has therefore renewed the interest in this field. It also means that the technology may not be applicable to high-pressure ratio liquid-fuelled aero machines. Although much has been published, data in the region of interest to high-pressure ratio gas turbines is extremely sparse. Similarly, modelled autoignition delay times are not very accurate, as most reaction mechanisms were not generated to cover this range of conditions. Hence the uncertainties of autoignition delay times at gas turbine conditions are significant, thereby either imposing over-stringent design limitations or introducing risks of ignition occurrence in the early design process.

This presentation attempts to outline what the technologies are. Demonstration of the problem with respect to what happens when proper account of autoignition on real combustion systems. Identify the gaps in knowledge and give some indicators to why some of the current techniques of measuring autoignition are inadequate.

Modes of autoignition

Derek Bradley, Leeds University

Recent computational studies with Xiao Gu, Chris Morley and David Emerson demonstrate five different modes of hot-spot autoignition. Although ignition delay times gives a good indication of when autoignition will occur, the mode of autoignition depends on the localised dimensionless temperature gradient, ξ , and the dimensionless rate of the principal heat release, ε . For given hot spot sizes ξ and ε can be computed from homogeneous chemistry. These parameters show how detonation can be avoided with less reactive mixtures. Octane numbers must be used with care in assessing controlled autoignition.

Autoignition and Fire and Explosion Hazards

Stuart Hawkworth, HSE.

This presentation discusses ignition incidents and re-creations of ignitions of flammable gas, vapour and sprays on hot surfaces. It highlights the prevalence of this hot surface ignition in certain industrial situations and compares them with observations made under more controlled laboratory conditions. Work is described for hot surfaces that range in size from 0.1 mm² to 0.2 m² with a range of geometries. A qualitative analysis of the parameters that affect ignition by hot surfaces is given to try and understand the difference between results obtained in the laboratory and incidents in the real world. A discussion of how such ignitions could possibly be prevented is also introduced.

Impressions of the 2003 Spring Technical Conference of the American Society of Mechanical Engineers held in Hellbrunn Castle, Salzburg, Austria on 11-13 May 2003

Sunday 11 May 2003

On reaching the beautiful city of Salzburg, I enjoyed the entire afternoon doing the typical tourist things - visiting the "Sound of Music" gardens, Mozart's birthplace etc. Also, this trip provided me a good chance to practice and improve my Deutsch. The Welcome Reception and Registration was a useful event in terms of networking with the scholars from the engine-research community. To be honest, I was pretty comfortable albeit being the only chemical engineer around and it being my first ever engine-related international conference.

Monday 12 May 2003

The technical session started promptly at 8.30 am and the keynote address was delivered by Dr Helmut List, chairman and CEO of AVL-List GmbH. It was a fascinating lecture, where Dr List emphasized the development in research and technology in the past decade and how it is being adapted for marine, locomotive and power generation engines to improve technology and cut down on emissions. Following the lecture I attended two technical sessions for the day - "Alternative fuels and fuel treatments" and "Engine design". The Questions & Answers' sessions following the presentations were indeed fruitful in terms of learning about the recent advances in modeling and experimental research related to engine research.

Tuesday 13 May 2003

The technical presentations on "Hydrogen fueled SI engines" and "Combustion analysis of a natural gas engine" were really impressive. In the afternoon session, I presented my paper entitled "Analysis of the HCCI combustion of a turbo-charged truck engine using a stochastic reactor model". I was pleased to get good reviews on the paper as well as answer the questions raised by the audience. In the same session, Professor J Caton's paper on "Determining NO_x emissions from SI engines" was very informative. It was indeed an impressive, clear-cut presentation and a unique learning opportunity for me.

Networking and cross pollination of ideas were again important features of this conference. I am grateful to the Combustion Institute (British Section), Hughes Hall College, Cambridge and Cambridge Commonwealth Trust for the financial support without which I would not have had this wonderful experience.

Amit Bhave
Department of Chemical Engineering
University of Cambridge

COMBUSTION-RELATED PAPERS PUBLISHED BY CI(BS) MEMBERS IN 2002

Although the present list involved considerable editing, I have not tried to inflict on it a particular style and have retained that sent to me by authors. I have tried to remove duplicates. The list is in alphabetical order of the surname of the first-mentioned author.

Members were asked twice to send in their publication lists; I am rather disappointed that not more did so. There are a number of well-known names missing as well as, I am sure, many others. The committee considered this to be an important annual exercise, partly as publicity for British combustion achievements. I should value members' views on the usefulness of this list; it takes much effort to produce and I should like to know that it is a worthwhile task.

Tony Burgess

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NEWS FROM THE SWEDISH SECTION

Stig Johansson reports that The Swedish Section for Detonics and Combustion affiliated with The Combustion Institute (Sektionen För Detonik Och Förbränning) is currently planning the 3RD DISPOSAL CONFERENCE on 10-11 November 2003, and, together with The Swedish Competence Centre for Energetic Materials, KCEM, the 13TH JAN HANSSON STABILITY SYMPOSIUM in May or June 2004.

3rd Disposal Conference: Probable papers are:-

Transnational transportation of waste.

Waste-fired boilers, some problems.

Some aspects of downsizing the Swedish armed forces.

Experiences of 33 years of demil at Vingåkersverken.

Weapons of mass destruction – a gigantic disposal challenge.

The economical value of environment-friendly disposal of explosives.

Explosion and fire hazard assessment. EU Directive 96/82 EC "SEVESO II".

Disposal of pyrotechnic waste from smoke cartridge production.

Demilitarisation of buried ammunition from the 2nd World War.

Biological treatment of sludge containing residues of explosives and pharmaceuticals.

A mobile facility for munitions and explosives.

Environmental research on munitions at FOI.

Organic compounds in residues from the incineration of municipal solid waste and biofuels.

Soil remediation of the Gyttopp factory.

Analysis of organic nitrogen compounds and their trans-formation in biologically treated sludge from pharmaceutical and explosives industry.

New training CD ROM package on inflammable materials.

Flame, detonation, explosion – when, where and how they occur.

Energy recovery from packaging waste – the result of 12 years' standardisation work.

Biological clearance and disposal of past military fields and explosives industry areas.

Destruction of N-compounds in supercritical water.

Mass detonation or recovery – environmental impact of different ammunition destruction methods.

Airbag pyrotechnics at the end of the road.

Cleaning of a nuclear-weapons base in Russia.

How environmentally dangerous are the heavy metals, and lead in particular.

Remediation of mercury-polluted sediments through deepfreezing.

Temporal behaviour of mine-resembling objects.

Re-use of a 900 metre deep copper mine for environment-friendly disposal of explosives.

Supercritical fluid technology within Chematur.

Testing of explosives stability and remaining shelf life of components in ammunition before recovery, modernisation, or demilitarisation.

Addressing environmental issues during acquisition.

Work place-based education of workers in the European explosives industry.

The 13th Jan Hansson Stability Symposium.

The conference series "International Symposium on Chemical Problems Connected with the Stability of Explosives" started in 1967 and has under the leadership of its "inventor", Dr Jan Hansson, become an internationally esteemed and exclusive forum for presenting recent R&D results and for discussing all kinds of stability-related issues. Dr. Hansson's death a few months before the 12th Symposium in 2001 made people wonder whether the series would be continued. It will. The 13th Symposium will take place at the end of May or beginning of June 2004. The venue has not yet been decided upon, but the special and much appreciated "Jan Hansson touch", ie a secluded place with atmosphere, will surely be retained. A first circular and call for papers will be distributed in August 2003.

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FIREWORKS

We all of us are tempted to watch a display of fireworks, except for those who disapprove of people enjoying themselves. Consequently, when a basic textbook on the simple combustion science of fireworks appears [1] it appeals to the curiosity. Particularly as the author is a chemist, whose birthday is November 5th (Overseas readers need not puzzle over the significance of that date). Inevitably he was drawn to a career in pyrotechnics.

The basic combustion process with fireworks is of course the deflagration of gunpowder, sometimes known as black powder from its colour. The secret of the spectacle is the design of how it is burned, and with what additives. Gunpowder is a mixture of three simple chemicals: carbon (charcoal), sulphur, and nitre (potassium nitrate); but the optimisation of these constituents is far from simple and took centuries to evolve because of the lack of chemical knowledge of what was happening.

The typical odour associated with firework displays tells us that the sulphur does not all burn to the acrid SO_2 or SO_3 , but that some produces H_2S . Where does the hydrogen come from? Mainly water, particularly from the charcoal where there are also some organic residues. So, even today there is no theoretically correct stoichiometry. Instead, for the last two centuries the mixture of the main constituents has been fixed rather arbitrarily as 75% KNO_3 , 15% C, and 10% S by weight, ignoring the water. Previously the mixtures had contained progressively less KNO_3 , possibly because it was the least available constituent.

Fireworks that were all bang and no sparkle or colour would rapidly lose their attraction, particularly to the elderly. So the manufacturer adds extras to produce effect. Simple colours are easy and are associated with inorganic compounds:

Red	Strontium
Orange	Calcium
Yellow	Sodium
Green	Barium
Blue	Copper

For the sparks metal elements are used: aluminium, iron, magnesium, and titanium.

More sophisticated effects are made with organic dyes, for extra colours, and other organic compounds to make whistling noises.

But none of this happens if the gunpowder mixture is unconfined. In the open air small quantities burn quietly, without spectacular effects. The design of the confinement is where the skill of the firework manufacturer shows itself. For example the "simple" rocket consists of a cylindrical combustion chamber closed at the top end and open via a choke or nozzle at the bottom. The gunpowder charge is pressed with a spike so that there is a deep conical indentation at the ignition end, which can increase the surface area of the propellant to a factor of 100 times the cross-sectional area of the choke, and thereby increase the burning rate proportionately. Thus having lit the blue touch paper, and retired immediately according to the manufacturer's instructions, observation shows that the rocket accelerates rapidly before plateauing as the burning area subsequently diminishes towards that of the cross-section of the combustion chamber. The burning rate also increases as the pressure in the chamber rises. Vieille's law states that:

$$R = 3.38p^{0.325}$$

Where R is the linear burning rate (mms^{-1}) and p is the chamber pressure (*pounds per square inch*); only a half-hearted application of SI units in a traditional industry. The numerical constants vary in magnitude according to the grade of the gunpowder, so empiricism survives. The porosity of the charcoal has to be optimised, and this is where the amateur manufacturer of fireworks usually fails. The rocket payload is in a separate section at the top end of the combustion chamber, and is lit by a short fuse when the motor burns out. A shower of sparks, accompanied by bangs, completes the show. The rocket stick has the essential functions of ensuring that the centre of gravity of the system is in the correct position during flight and that the orientation of the rocket is maintained. Other types of firework also require confinement of the gunpowder and the correct sequence of burning of the contents.

Confinement of gunpowder to produce a bang does not necessarily require a combustion chamber; the centre of a large heap can act as a substitute. Over the years this was found out by trial and error, particularly error. In Britain in 1742, during the reign of King George II, an Act of Parliament was passed “for preventing the Mischiefs which may happen by keeping too great Quantities of Gunpowder in or near the Cities of London and Westminster, or the Suburbs thereof. It shall not be lawful to have or keep more than two hundred pounds of gunpowder at any time in any house, storehouse, shop, cellar or other places.....under the same roof, or in any yard within the cities of London and Westminster, or either of them, or within three miles of the Tower of London, or within three miles of His Majesty’s Palace at Saint James’s (*the King’s personal residence in London*) or within two miles of any magazine created for keeping gunpowder belonging to His Majesty, His Heirs, and Successors....upon forfeiting such gunpowder and the value thereof”. And so on; the implication is clear. His Majesty was of course the user of gunpowder as a munition of war, and its manufacturing centre near London was at Waltham Abbey, Essex, from where it was transported by river barge to warships on the Thames. Much safer than by using horses and wagons on poor roads. Waltham Abbey was established in the 1660s and produced explosives (latterly a great deal more potent than gunpowder) until 1947, after which it became a research establishment until its closure in 1991. For more details try www.royalgunpowdermills.com.

Recognition of the hazard of gunpowder, and in quantifying safety distances, is a simple application of Risk Assessment which has grown in sophistication over the years. Currently whenever there is a safety problem it is likely to be called up, particularly for societal aspects. It qualifies for the title of Flavour of the Month. On the other hand there are still limits to its current use. An enterprising practitioner should consider applying Risk Assessment to Matrimony. Not so much an opportunity Niche, more a Grand Canyon. All it needs is a website, so that the practitioner is out of shotgun range.

Gunpowder originated in China, several centuries before the news arrived in Europe. In pursuing the history of Chinese science, written in English, the name of Joseph Needham, FRS, FBA, comes to mind (or should do). He produced an encyclopaedic series of books on Chinese science and civilisation, and devoted a whole volume to gunpowder, tracing its progress from the Orient to medieval Europe [2].

At the start of the book, in an Author’s Note, he wrote “This volume has been forty-three years in the gestating”. A tribute to the far-sightedness and patience of (some) book publishers. Needham was able to spend much time in the second half of the last Century studying and consulting in China, amidst all the military and political turmoil. His own political views (infra-red) may have assisted his freedom to work and discuss. He believed that the development of gunpowder was certainly one of the greatest achievements of the medieval Chinese world, and the greatest of all Chinese military inventions.

The beginning of it was in the 9th Century (AD), when the first reference to the mixing of saltpetre, sulphur, and carbonaceous material is found. This occurs in a Taoist book which strongly recommends alchemists not to mix these substances, especially with the addition of arsenic. Some of those who have done so have had the mixture deflagrate, singe their beards, and burn down the building in which they were working. Such accidents could bring Taoism into disrepute. Possibly gunpowder may have arisen from earlier practices such as the burning of incense and fumigation, for hygienic and insecticidal reasons, in the annual purification of dwellings. (Did the Chinese invent Spring Cleaning as well?).

During the second half of the 12th Century two types of fireworks appeared. Firstly, a bamboo tube filled with gunpowder and having a small orifice through which the gases could escape. When lit it shot about in all directions on the floor. Secondly, if attached to a stick, it flew off into the air. The latter was soon adapted for military purposes; when dosed with arsenic it became both an incendiary and a toxicological weapon, useful when attacking besieged towns. Soon afterwards guns were invented.

Needham thought the most extraordinary fact was that all the stages, from the incendiary uses of gunpowder right through to the metal-barrel hand-gun, with the projectile fully occupying the bore, were passed through in China, before Europeans knew of the mixture itself. It was not until the middle of the 13th Century that the English monk Roger Bacon devised and experimented with gunpowder. He was sentenced to 10 years detention for “fiendish alchemy”. But in his favour he invented the magnifying glass, expounded on reflection and refraction of light, suggested a revised calendar and a lighter-than-air machine, emphasised the importance of mathematics as a subject for study, and wrote a treatise on “the means of warding off the infirmities of old age”.

As we all know, fascination with combustion persisted and expanded. Needham quotes a translation of Johann Becher, *Physica Subterranea* 1703, “the Chymists are a strange Class of Mortals, impelled by an incomprehensible Impulse to take their Pleasure amid Smoke and Vapour, Fume and Flame, Poisons and Poverty – yet among all these Evils, I seem to live so sweetly that may I die if I would change places with the Persian King!”.

Long may it be so (Persian Kings come and go).

References

1. Russell, M S. *The Chemistry of Fireworks*. Royal Society of Chemistry, Cambridge. 2000. ISBN 0 85404 598 8.
2. Needham, J. *Science and Civilisation in China*. Vol. V: Part 7. Cambridge University Press. Cambridge, 1986.

Ken Palmer

COMBUSTION CALENDAR

There are a number of useful websites which give information about forthcoming meetings. It seems a good idea to list some here. If members know others, please let me know and I shall add them to this list:-

<http://www.combustioninstitute.org>
<http://www.combustion-net.com/calendar/calendar-current.htm>
<http://www.afm.asso.fr>

2003

JULY 2003

13-17 JULY

Izmir, Turkey. THE FIRST INTERNATIONAL EXERGY, ENERGY AND ENVIRONMENT SYMPOSIUM (IEEES-1). Details: Professor Ibrahim Dincer, Department of Mechanical Engineering, King Fahd University of Petroleum and Minerals (KFUPM), Box 127, Dhahran 31261, Saudi Arabia. Tel: +966 3 860 4497, Fax: +966 3 860 2949, e-mail: idincer@kfupm.edu.sa, web: www.geocities.com/ibrahimdincer

14-15 JULY

Houston, Texas, USA. MCCLOSKEY'S PETCOKE CONFERENCE. Details: Justine Clark, Tel: 01730 265095, Fax: 01730 269032, e-mail: justine.clark@mccloskeycoal.com, web: <http://www.globalcoal.com/mcis/news/searchnews.cfm>

19-23 JULY

Las Vegas, Nevada, USA. ASME SUMMER HEAT TRANSFER CONFERENCE. Details: V P Carey, e-mail: vcarey@me.berkeley.edu, web: www.asmeconferences.org/ht03/

21-24 ? JULY

Sorrento, Italy. 7th TRIENNIAL INTERNATIONAL SYMPOSIUM ON FLUID CONTROL, MEASUREMENT AND VISUALIZATION. Details: G Carlopmano, Tel: +39 081 768 2178, Fax: +39 081 239 0364, e-mail: flucome@unina.it, web: <http://www.flucome.unina.it>

28 JULY-1 AUGUST

Hakone, Japan. 19TH ICDERS. Details: web: <http://19thicders.matsuo.mech.keio.ac.jp/>

AUGUST 2003

6-8 AUGUST

Columbus, Ohio, USA. COAL-GEN 2003 CONFERENCE & EXHIBITION. Details: Donna Welch, Tel: +1 713 963 6287, Fax: +1 713 963 6280, e-mail: donnaw@pennwell.com, web: www.coal-gen.com

10-15 ? AUGUST

Ottawa, Canada. 39th IUPAC CONGRESS AND 86th CONFERENCE OF THE CANADIAN SOCIETY FOR CHEMISTRY. Details: <http://www.nrc.ca/confserv/iupac2003>

17-22 ? AUGUST

Queens College, Oxford, England. GORDON RESEARCH CONFERENCE ON LASER DIAGNOSTICS IN COMBUSTION. Details: M Alden, Department of Combustion Physics,

P.O. Box 118, S-221 00 Lund, Sweden, Tel: +46 (0) 46 222 7657, Fax: +46 (0) 46 222 4542, e-mail: marcus.alden@forbrf.lth.se or Gordon Research Center, University of Rhode Island, P.O. Box 984, West Kingston, RI 02892, USA. Tel: +1 401 783 4011, Fax: +1 401 783 7644, e-mail: grc@grcmail.grc.uri.edu, web: <http://www.grc.uri.edu>

17-22 AUGUST

Cesme, Turkey. INTERNATIONAL SYMPOSIUM ON TRANSIENT CONVECTIVE HEAT AND MASS TRANSFER IN SINGLE AND TWO-PHASE FLOWS. Details: Faruk Arinc, ICHMT Secretary General, Mechanical Engineering Department, Middle East Technical University, 06531 Ankara, Turkey. Tel: +90 312 210 5214/1429, Fax: +90 312 210 1331/1266, e-mail: arinc@metu.edu.tr

20-22 AUGUST

Seattle, Washington, USA. 2003 INTERNATIONAL ENERGY PROGRAM EVALUATION CONFERENCE. Details: Cara Lee Mahany Braithwait, Conference Coordinator, 4610 University Avenue, Suite 700, Madison, Wisconsin 53705, USA. Tel: +1 608 231 2552, Fax: +1 608 231 1365, e-mail: samb@lrca.com

DATES IN SEPTEMBER, OCTOBER & NOVEMBER

London, England. A series of courses on Energy Management:

18 SEPTEMBER: PART L BUILDING REGULATIONS

8 OCTOBER: MONITORING AND TARGETING

16 OCTOBER: EDUCATING THE WORKFORCE

6 NOVEMBER: RENEWABLES

26 NOVEMBER: ENERGY AUDITING

Details: The Events Office, Institute of Energy, 18 Devonshire St., London W1G 7AU, England. Tel: 020 7580 0008, Fax: 020 7580 4420, e-mail: events @ instenergy.org.uk

SEPTEMBER 2003

1-5 SEPTEMBER

Leeds, England. SPARK IGNITION ENGINE COMBUSTION, A short course. Details: Alison Whiteley, CPD Unit, School of Process, Environmental and Materials Engineering, (SPEME), University of Leeds, LEEDS, LS2 9JT, England. Tel: 0113 343 2494, Fax: 0113 343 2511, e-mail: cpd.speme@leeds.ac.uk, web: www.leeds.ac.uk/fuel/shortc/sc.htm

2-5 SEPTEMBER

Ustron, Poland. 18TH INTERNATIONAL SYMPOSIUM ON COMBUSTION PROCESSES. Organized by Institute of Thermal Technology, Silesian University of Technology, Gliwice, Poland, coorganized by the Polish Academy of Science. Details: Andrzej Szlek, 18th Symposium on Combustion Processes, Konarskiego 22, 44-100 Gliwice, Poland. e-mail: socp18@itc.ise.polsl.gliwice.pl, or szlek@zeus.polsl.gliwice.pl
web: www.ise.polsl.gliwice.pl/socp18

3 SEPTEMBER

London, England. TOWARDS ZERO CARBON: RENEWABLES, FUEL CELLS AND EMBEDDED GENERATION. A meeting organised by The Institute of Energy and the Solar Energy Society (UK-ISES). Details: The Events Office, Institute of Energy, 18 Devonshire St., London W1G 7AU, England. Tel: 020 7580 0008, Fax: 020 7580 4420, e-mail: events @ instenergy.org.uk

7-11 SEPTEMBER

New York City, NY, USA. 226th NATIONAL MEETING OF THE AMERICAN CHEMICAL SOCIETY. Details: Meetings Department, American Chemical Society, 1155 - 16th Street, NW, Washington, DC 20036, USA. Tel: +1 202 872 4396, Fax: +1 202 872 6128, e-mail: natlmtgs@acs.org

8-12 SEPTEMBER

Londonderry, Northern Ireland, UK. 4TH INTERNATIONAL SEMINAR ON FIRE AND EXPLOSION HAZARDS. Seminar Themes will include Combustion fundamentals of fires and explosions, Fire and explosion physics, chemistry and fluid dynamics, Modelling and simulations of fires and explosions, Fires and explosions in buildings, including structural fire engineering, Industrial fire and explosion safety, including venting of deflagrations, Backdraught, flashover and smoke explosions, Fire and explosion hazards of substances and materials, Performance-based fire safety engineering, Fire and explosion statistics, databases, case studies and risk assessment, Prevention of fires and explosions, Hazards assessment and disaster management, Evacuation modelling, Underpinning education. Details: Laura Robinson, 4th International Seminar on Fire and Explosion Hazards, FireSERT, University of Ulster, Newtownabbey, County Antrim, BT37 0QB, N. Ireland. Tel: 028 9036 8731/028 9036 6922, Fax: 028 9036 8700, e-mail: l.robinson@ulster.ac.uk, web: www.engj.ulster.ac.uk/4thisfeh

10-12 SEPTEMBER

Harrogate, England. THE ENVIRONMENT – VISION, VALUES AND INNOVATION. Details: CIWEM/Aqua Enviro Technology Transfer, Richmond House, 16 Blenheim Terrace, Leeds LS2 9HN. Tel: 0133 244 2166, e-mail: sarahhickinson@aquaenviro.co.uk

14-19 SEPTEMBER

Capri, Naples, Italy. 6TH ICE2003: INTERNATIONAL CONFERENCE ON ENGINES FOR AUTOMOBILES. Details: e-mail: ICE2003@im.na.cnr.it
web: <http://www.im.na.cnr.it/meetings>

14-19 SEPTEMBER

Beijing, China. 3RD INTERNATIONAL METHANE AND NITROUS OXIDE CONFERENCE. Details: Clark Talkington. Tel: +1 202 564 8969, e-mail: talkington.clark@epa.gov **or** Lin Xin, Tel: +86 10 8461 2010, e-mail: cbmc@public.bta.net.cn
web: www.ergweb.com/methane_china

15-19 SEPTEMBER

Leeds, England. FIRE AND EXPLOSION – PROTECTION AND INVESTIGATION, A short course. Details: Alison Whiteley, CPD Unit, School of Process, Environmental and Materials Engineering, (SPEME), University of Leeds, LEEDS, LS2 9JT, England. Tel: 0113 343 2494, Fax: 0113 343 2511, e-mail: cpd.speme@leeds.ac.uk, web: www.leeds.ac.uk/fuel/shortc/sc.htm

17 SEPTEMBER

Loughborough, England. EXPLOSION AND SAFETY ISSUES. A UKELG Discussion Meeting. Details: Martin Braithwaite, UKELG Secretary, RMCS, Cranfield University, Shrivvenham, Swindon SN6 8LA, England. e-mail: M.Braithwaite@rmcs.cranfield.ac.uk, web: <http://neumann.dph.aber.ac.uk/home.html>

18 SEPTEMBER

Loughborough, England. CURRENT RESEARCH IN COMBUSTION: A Forum for Research Students and Young Researchers. A one-day meeting of the Combustion Physics Group of the Institute of Physics. Details: Jeff Allen, Scion-Sprays Ltd., Norwich

Research Park, Colney, Norwich NR4 7UT Norfolk, England. Tel: 01603 457745 Fax: 01603 457764 E-mail: jeff@scion-sprays.co.uk or Ralph Boyce, Combustion Systems, Rolls-Royce plc, PO Box 31, Derby DE24 8BJ. Tel: 01332 248631 Fax: 01332 245654 E-mail: ralph.boyce@rolls-royce.com. See this *Newsletter* for more details.

18 SEPTEMBER

Loughborough, England. **AGM OF THE COMBUSTION INSTITUTE (BRITISH SECTION)**. To be held during the IOP meeting (see previous entry in Calendar). Details: Dr Yajue Wu, Department of Chemical and Process Engineering, Sheffield University, Mappin Street, Sheffield S1 3JD, England. Tel: 0114 222 7514, Fax: 0114 222 7501, E-mail: y.wu@sheffield.ac.uk

19-23 SEPTEMBER

Pittsburgh, Pennsylvania, USA. 20TH ANNUAL INTERNATIONAL PITTSBURGH COAL CONFERENCE. Details: Conference Secretary, Tel: +1 412 624 7440, Fax: +1 412 624 1480, e-mail: pcc@enr.pitt.edu, web: <http://www.enr.pitt.edu/pcc>

20-24 SEPTEMBER

Vancouver, BC, Canada. COMBUSTION CANADA CONFERENCE 2003, Details Nicole Miljour, Conference Coordinator, Tel: +1 613 947 5190, Fax: +1 613 995 9584, e-mail: nicole.miljour@nrcan.gc.ca, web: <http://www.combustioncanada.ca>

22-23 SEPTEMBER

Leeds, England. INCINERATION OF MUNICIPAL WASTE, A short course. Details: Alison Whiteley, CPD Unit, School of Process, Environmental and Materials Engineering, (SPEME), University of Leeds, LEEDS, LS2 9JT, England. Tel: 0113 343 2494, Fax: 0113 343 2511, e-mail: cpd.speme@leeds.ac.uk, web: www.leeds.ac.uk/fuel/shortc/sc.htm

23-25 SEPTEMBER

Leeds, England. FLAME RETARDANCY AND FLAMMABILITY OF POLYMERS AND TEXTILES, A short course. Details: Alison Whiteley, CPD Unit, School of Process, Environmental and Materials Engineering, (SPEME), University of Leeds, LEEDS, LS2 9JT, England. Tel: 0113 343 2494, Fax: 0113 343 2511, e-mail: cpd.speme@leeds.ac.uk, web: www.leeds.ac.uk/fuel/shortc/sc.htm

29-30 SEPTEMBER

Nice, France. 2ND ANNUAL EUROPEAN COAL OUTLOOK CONFERENCE. Details: Morenike Ogunmefun, Tel: 01932 893895, Fax: 01932 893858, e-mail: cust.serv@informa.com, web: <http://www.coalevents.com>

29 SEPTEMBER-3 OCTOBER

Fodele Beach, Crete, Greece. FOURTH INTERNATIONAL CONFERENCE ON COMPACT HEAT EXCHANGERS AND ENHANCEMENT TECHNOLOGY FOR THE PROCESS INDUSTRIES, Details: R K Shah, Tel: +1 585 475 6775, Fax: +1 585 475 7710, web: rkshah@attglobal.net

OCTOBER 2003

6-10 OCTOBER

USA. DIESEL PARTICULATES AND NO_x EMISSIONS, A short course. Details: Alison Whiteley, CPD Unit, School of Process, Environmental and Materials Engineering, (SPEME), University of Leeds, LEEDS, LS2 9JT, England. Tel: 0113 343 2494, Fax: 0113 343 2511, e-mail: cpd.speme@leeds.ac.uk, web: www.leeds.ac.uk/fuel/shortc/sc.htm

12-15 OCTOBER

San Francisco, CA, USA. GASIFICATION TECHNOLOGIES COUNCIL ANNUAL CONFERENCE, Details: <http://www.gasification.org/>

12-17 OCTOBER

Antalya, Turkey. ICHMT INTERNATIONAL SYMPOSIUM ON "TURBULENCE, HEAT AND MASS TRANSFER. Details: Faruk Arinc, ICHMT Secretary General, Mechanical Engineering Department, Middle East Technical University, 06531 Ankara, Turkey. Tel: +90 312 210 5214 and 1429, Fax: +90 312 210 1331 and 1266, e-Mail: arinc@metu.edu.tr, web: www.ichmt.org/Thmt-03

25-28 OCTOBER

Orléans, France. EUROPEAN COMBUSTION MEETING 2003. Details: web: <http://www.cnrs-orleans.fr/ECM2003/> **or** British Section Secretary.

29-30 OCTOBER

Pittsburgh, Pennsylvania, USA. SELECTIVE CATALYTIC REDUCTION AND SELECTIVE NON-CATALYTIC REDUCTION FOR NOX CONTROL CONFERENCE. Details: Karen Lockhart, Tel: +1 412 386 6044, Fax: +1 412 386 4604, e-mail: kimberly.yavorsky@netl.doe.gov

NOVEMBER 2003**2-6 NOVEMBER**

Cairns, Queensland, Australia 12th International Conference on Coal Science, Details: Roy Jackson, Tel: +61 2 4393 1114, Fax: +61 2 4393 1114, e-mail: iccs@aie.org.au, web: www.aie.org.au/iccs

2-7 NOVEMBER

Tokyo, Japan. INTERNATIONAL GAS TURBINE CONGRESS. Details: T Watanabe, Tel: +81 3 5841-6622, e-mail: watanabe@aero.t.u-tokyo.ac.jp, web: www.soc.nii.ac.jp/gtsj/igtc/IGTC'03Tokyo.html

10-11 NOVEMBER

Sweden. 3RD DISPOSAL CONFERENCE 2003. Organised by The Swedish Section for Detonics and Combustion affiliated with The Combustion Institute. Details: Stig Johansson, e-mail: srj@telia.com. See this *Newsletter* for more details.

17-21 NOVEMBER

Leeds, England. SPARK IGNITION ENGINE EMISSIONS, A short course. Details: Alison Whiteley, CPD Unit, School of Process, Environmental and Materials Engineering, (SPEME), University of Leeds, LEEDS, LS2 9JT, England. Tel: 0113 343 2494, Fax: 0113 343 2511, e-mail: cpd.speme@leeds.ac.uk, web: www.leeds.ac.uk/fuel/shortc/sc.htm

DECEMBER 2003**8-9 DECEMBER**

Melbourne, Victoria, Australia. 2003 AUSTRALIAN SYMPOSIUM ON COMBUSTION. A meeting co-organised by the Australian and New Zealand Sections of the Combustion Institute and the Australian Flame Research Committee of the IFRF. Details: Damon

Honnery, Tel: +61 3 9905 1988, Fax: +61 3 9905 1825, e-mail: damon.honnery@eng.monash.edu.au, web: <http://ltrac.eng.monash.edu.au/CISYM-2003/>

2004

JANUARY 2004

19-23 JANUARY

Leeds, England. FIRE DYNAMICS AND MODELLING, A short course. Details: Alison Whiteley, CPD Unit, School of Process, Environmental and Materials Engineering, (SPEME), University of Leeds, LEEDS, LS2 9JT, England. Tel: 0113 343 2494, Fax: 0113 343 2511, e-mail: cpd.speme@leeds.ac.uk, web: www.leeds.ac.uk/fuel/shortc/sc.htm

MARCH 2004

22-26 ? MARCH

Montreal, Canada. NATIONAL MEETING OF THE AMERICAN PHYSICAL SOCIETY. Details: American Physical Society, Meetings Department, One Physics Ellipse, College Park, MD 20740, USA. Tel: +1 301 209 3280, Fax: +1 301 209 0867, web: <http://www.aps.org>

28 MARCH-1 APRIL

Anaheim, California, USA. 227th NATIONAL MEETING OF THE AMERICAN CHEMICAL SOCIETY. Details: Meetings Department, American Chemical Society, 1155 - 16th Street, NW, Washington, DC 20036, USA. Tel: +1 202 872 4396, Fax: +1 202 872 6128, e-mail: natlmtgs@acs.org

APRIL 2004

19-23 APRIL 2004

Leeds, England. DIESEL PARTICULATES AND NO_x EMISSIONS, A short course. Details: Alison Whiteley, CPD Unit, School of Process, Environmental and Materials Engineering, (SPEME), University of Leeds, LEEDS, LS2 9JT, England. Tel: 0113 343 2494, Fax: 0113 343 2511, e-mail: cpd.speme@leeds.ac.uk, web: www.leeds.ac.uk/fuel/shortc/sc.htm

APRIL (date to be finalised)

Norway (a six-day cruise on a Norwegian ship between Kirkenes and Bergen). ICHMT SYMPOSIUM: CHT-04 ADVANCES IN COMPUTATIONAL HEAT TRANSFER. Details: Graham de Vahl Davis or Eddie Leonardi, CFD Research Laboratory, School of Mech. & Manuf. Engineering, The University of NSW, Sydney, NSW, Australia 2052. Tel: +61 2 9385 4099 / 4254, Fax: +61 2 9663 1222, e-mail: cht04@cfd.mech.unsw.edu.au web: <http://www.hurtigruten.com/uk/produkt.html>

MAY OR JUNE 2004?

Sweden (to be announced). INTERNATIONAL SYMPOSIUM ON CHEMICAL PROBLEMS CONNECTED WITH THE STABILITY OF EXPLOSIVES. The 13th Jan Hansson Stability Symposium, 2004. Organised by The Swedish Section for Detonics and Combustion affiliated with The Combustion Institute, together with The Swedish Competence Centre for Energetic Materials, KCEM. Details: Stig Johansson, e-mail: srj@telia.com. See this *Newsletter* for more details.

JULY 2004

25-30 JULY

Chicago, Illinois, USA. THIRTIETH INTERNATIONAL SYMPOSIUM ON COMBUSTION. Details: Sue S Terpack, The Combustion Institute, 5001 Baum Boulevard, Suite 635, Pittsburgh, PA 15213-1851, USA Tel: +1 412 687 1366, Fax: +1 412 687 0340, e-mail: 30thsym@combustioninstitute.org

Instructions on submission of papers see: <http://combustioninstitute.org/30sym.html>

Instructions on submission of wipps see: <http://combustioninstitute.org/30thwipp.html>

For additional information on location etc see: www.engr.uic.edu/combustion2004

See also this *Newsletter*.

2005

JULY 2005

10-14 JULY

Glasgow, Scotland. 7TH WORLD CONGRESS OF CHEMICAL ENGINEERING. Organised by the Institution of Chemical Engineers for the European Federation of Chemical Engineering. Details: Concorde Services Ltd., 4b, 50 Speirs Wharf, Port Dundas, Glasgow G4 9TB, Scotland. Tel: 0141 331 0123, Fax: 0141 331 0234, e-mail: info@chemengcongress2005.com

ADVERTISEMENTS

Professorship in mechanical process engineering at The Technical University of Clausthal, Germany

In this specialist subject area of mechanical engineering, process engineering and chemistry at The Technical University of Clausthal, a position is available for a Professorship (Bes.Gr. W3 BBesO) in the field of mechanical process engineering. The position is open to suitable candidates until 01.04.2004.

A thorough and demonstratable appreciation of relevant background theory and current and future research requirements is expected from the candidate. Due to the strong historical and current linkage between the process engineering field and The Technical University of Clausthal the University expects in co-operation with the departments of materials sciences and mechanical engineering an interdisciplinary co-operation regarding the development of new products and processes and/or industrial process engineering systems. One significant research area to be addressed includes the production and/or handling of nano-particles in association with conventional areas of classical mechanical process engineering.

Lectures in basic and advanced mechanical process engineering for the various student courses in process technology, chemical engineering and environmental engineering are expected to be given by the successful candidate. The ability to give these classes in English is expected.

The applicant should be in at least one of the above mentioned areas a scientifically proven track record and evidence of interdisciplinary co-operation.

An important conditions applied to the post is that of qualifications, and includes (proof of higher education graduation, teaching experience, special capability for independent scientific work and further additional scientific achievements). Additional scientific

achievement can also be supported by a Habilitation or a comparable acceptable achievement. The applicant should have relevant industrial experience of several years.

The Technical University of Clausthal aims to increase the portion of women employees in its research and teaching areas. TU Clausthal requests and encourages therefore qualified female scientists or engineers to apply. Female applicants, who have the equivalent qualifications, will be preferred. Disabled applicants with the equivalent qualifications will also be preferred.

Applicants, who are under 45 year of age at the time of an offer will be employed as a Civil Servant (Beamter). Those who are over 45 years of age at the time of an offer and not employed currently as a Civil Servant will be employed as direct employer (Angestellter). Interested applicants should write in confidence with a covering letter explaining why they feel they are suitable for the position enclosing a full CV and a list of publications. This documentation should be addressed to:

**The Dean of the Faculty of Mining, Metallurgical Engineering and Manufacturing,
T U Clausthal
Leibnizstr. 8
38678 Clausthal-Zellerfeld
Germany**

The closing date for applications is 25.08.2003.



Drop tube furnace available

The Department of Chemical Engineering of University College London is currently renewing its laboratory facilities. A full Drop Tube Furnace is available FREE OF CHARGE to any Company or Research Institution.

The furnace is especially designed for experimental work on liquid fuel combustion (up to heavy fuel oils, residual fuels and emulsions) and emissions (NO_x, SO_x, particulates, etc) and is adaptable for solid fuel combustion. The furnace is well equipped with a variety of gas analysers, movable probes for variable sampling (combustion gases and solids), zonal temperature controllers (up to 1300 °C), full furnace management system, and computer and data-logging system.

The furnace has operated satisfactorily in research work for Universities and also contract work for private companies.

A description of the furnace and its capabilities can be seen at:-

<http://www.chemeng.ucl.ac.uk/research/combustion/equip.html#DTF>

and a full photograph and list of equipment is available at:-

<http://www.chemeng.ucl.ac.uk/research/combustion/df.html>

The only costs involved will be those of dismantling, removal and re-assembly. Preliminary estimates for these are available.

If interested, please get in touch initially with Javier Molero at:-

<javier.molero@sener.es>