HOW GREEN IS MY VALLEY –
Grass as an Engineering Material Feedstock

A consortium of Welsh industrial partners is benefiting from the expertise available at the Centre for Advanced and Renewable Material (CARM) in Bangor thanks to the WDA KEF-CIRP fund.

Wales has a commitment to sustainable development that is built into its constitution through section 121 of the Government for Wales Act and this project is seeking ways of developing environmentally friendly materials for Welsh companies.

The Chemistry Department and BioComposites Centre at the University of Wales, Bangor are focussing on the exploitation of grass as a sustainable feedstock for commercial chemical and fibre production.

The renewable energy market and the increased recycling are impacting on fibre resources. Cheap alternative sources are needed for composite production (e.g. MDF) and as reinforcement agents in concrete, ceramic tile adhesive and renders.

The increasing cost of petroleum and the environmental burdens of traditional production processes are reducing the competitive ability of the chemical sector. Bioderived chemicals with low embodied energy are needed in a range of industrial and consumer products.

The team is investigating the development of grass crop fractions as feedstocks for two industrial demands for fibre and chemicals, see figure 1. Work to date has already established value added products by conducting pilot scale industrial trials within the consortium. It is hoped that this work will lead to scale up of technologies and deliver commercial benefits to the industrial partners.

Consortium of Partners
The project partners represent a broad cross section of potential end-users that are interested in applications for fibres and chemicals in industrial products (construction and fine chemical) to household consumer items. The partners also bring extensive supply chain, product development and market expertise to the consortium, which will be essential for the exploitation of the project's results.

Benefit to Wales
The project will benefit the Welsh economy, particularly by strengthening the chemicals sector, and benefit the Welsh environment by moving industry away from wasteful, high-embodied energy and fossil carbon feed-stocks towards renewable, sustainable low net-carbon impact feedstocks.


Products made from grass

For further information contact Dr Rob Elias, CARM, Tel: 01248 364829, Email: r.m.elias@bangor.ac.uk

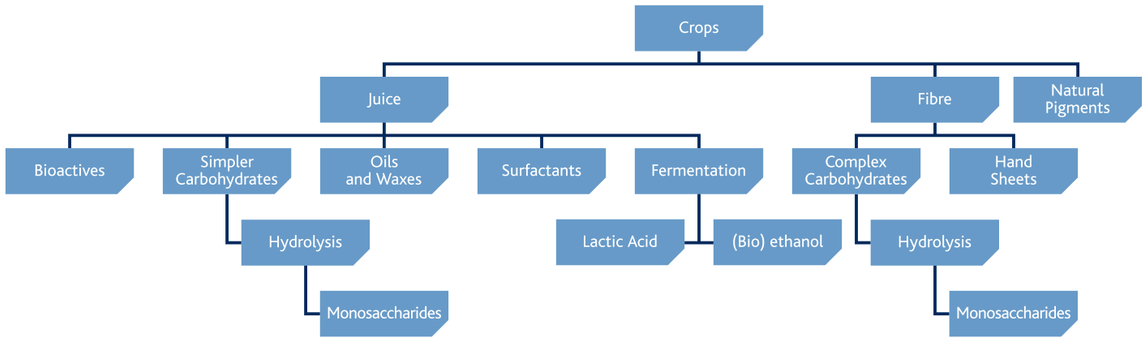

Figure 1. Flow diagram of fractionation opportunities

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MNW Annual Prestigious Event

11th MAY 2006, AIRBUS, BROUGHTON

Keynote Speakers:

David Phipps, Head of Composites, Airbus
Jason Rowe, Lotus Engineering

For further information and to register for this event go to www.mnw.org.uk

MNW Member Benefits

Eazyweb are pleased to offer members of the Materials Network Wales a 20% discount on their services. For members who don't have a web site they offer a new website building tool eazysitebuilder.com where you can build your own website.
For members who do have a web site they offer an updating service.

For further information contact: toby.maxwell-lyte@eazyweb.net

BRE Opens Office in Wales

The Building Research Establishment (BRE) have set up a new office in Wales at ECM[2] in Port Talbot, with the objective of innovating the Build Environment Sector in Wales. In addition to drawing on the capabilities of their parent company in Watford, the team in Wales will specialise in: innovative building products, product certification and environmental profiling, sustainable development in the built environment, innovation in housing and the use of Modern Methods of Construction (MMC), minimizing construction waste and whole life cost of buildings.

If you would like to work with BRE or require any additional information about their range of services, contact Nick Tune on 01639 864760 (tunen@bre.co.uk), web: www.bre.co.uk

WDA2216-1205

bulletin
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Materials Science Research in Space – IMPRESS Project Update

Report by Dr Nick Lavery

It has been just over a year since the IMPRESS project started in November 2004 and the MNW bulletin featured an article on the project in last year's winter edition ('Swansea Helping Develop Space-Age Materials For Greener Power'). For those who missed the first article, IMPRESS is a 5-year EC integrated project which is looking at the relationship between the processing, structure and properties of novel intermetallic alloys, to help produce new materials (e.g. titanium aluminides) ideal for high-performance gas turbine blades. These light-weight blades have applications in aerospace and power generation turbines, and have the potential to increase fuel efficiency and reduce CO_2 emissions. Other alloy compositions being looked at include nickel-based aluminides to be used, in powder form, for applications such as hydrogen fuel cell electrodes.


Figure 1 – Launch of the ESA/DLR-funded Texus 42 sounding rocket on the 1st December, 2005 (Photo courtesy of ESA/DLR)

The project, coordinated by the European Space Agency (ESA), comprises 42 research groups with 150 leading materials scientists from across Europe and Russia, also including scientists from the University of Wales Swansea's Materials Research Centre, Drs Steve Brown, Martin Bache and Nick Lavery. UK-based industrial collaborators include Rolls-Royce, NPL, CERAM and Qinetiq.

Over the first year alone there have been a number of significant technical achievements and important milestones to the project. In June 2005, a 2nd plenary meeting was held in Stockholm Sweden at which the newly established International Advisory Board was introduced to the scientific team, and included distinguished members such as Vladimir Fortov, ex-deputy prime minister of Russia and head of the Russian Academy of Science. Technical achievements were highlighted by the publication of over 17 journal and conference publications, and in particular, this included an article published in 'Materials World' in August 2005. The initial alloy selection has been made and castings of gamma-titanium-aluminium bars have been distributed to the various partners who have started working on the property characterisation and mechanical testing.

During an IMPRESS project training course on 'Materials Science in Microgravity' hosted by ESA in the Netherlands on the 1st December, it was announced that the first launch of an experimental payload onboard an ESA/DLR-funded Texus 42 sounding rocket, from the Esrange launch site near Kiruna in northern Sweden, had been successful. This experimental payload, jointly developed by ESA and DLR (Deutsches Zentrum für Luft- und Raumfahrt, the German Aerospace Centre) as part of the IMPRESS project, gave over six minutes micro-gravity time during which accurate measurements were made of the thermo-physical properties of highly-reactive liquid TiAl alloys using the Electro-Magnetic Levitator (EML). While the data obtained is currently being processed, it is expected to complement earlier data obtained by similar methods on parabolic flights.

These material properties will provide the computer modelling of advanced solidification processes with essential data to fine-tune the models which have also been under development since the start of the project. The modelling has already greatly assisted the design of the casting process which will be used for casting the prototype turbine blades at Birmingham University and ACCESS e.V. in Germany.

Following a first successful annual EC review meeting, the project is firmly on track and has been commended upon its achievements in the first year.

The next IMPRESS Scientific Forum shall take place in San Sebastian, Spain from the 8th-10th May 2006, hosted by INASMET. More information on the project can be found on the web site (http://www.spaceflight.esa.int/impress), or for more specific details about Swansea's specific involvement in the project, feel free to contact **Dr Lavery (N.P.Lavery@swansea.ac.uk).**

Chairman's Corner

I am writing this Bulletin just before the festive season and therefore, on behalf of your Steering Committee, would like to wish all our members and supporters a very successful New Year. I can also assure you that in 2006 the MNW will continue to provide support through our networking at Seminars, our Bulletin and our Web Site.

In this Bulletin we are continuing our themed approach by focussing specifically on research of relevance being carried out within the academic environment. You will find specific articles on the Materials Research Centre at Swansea, the European Space Agency IMPRESS programme, magnetic materials and a major collaborative research project. It will be evident from these articles that Universities in Wales are involved in Materials research at the highest levels. Some of you may feel that the areas covered are outside your own particular interests but please bear in mind that there can be substantial spin offs from the types of programme highlighted.

Aerospace features significantly in our coverage. It is fitting therefore to highlight the Royal Academy of Engineering lecture, Reception and Dinner to be held at Swansea on 14th February 2006. The event will include detailed insights into the Airbus A380 from Frank Ogilvie who is Aerodynamics Director and Deputy Head of overall Aircraft Design A380. The event will also be attended by the President of the Royal Academy of Engineering, Lord Broers. Once again, further details can be found in the Bulletin.


Professor John Evans

INSIDE: This issue features the work of Welsh universities active in materials research

Aerospace Materials Research at Swansea

The Materials Research Centre (MRC) at the University of Wales Swansea is a lead centre for research on aerospace materials in the UK.

A recently awarded EC Framework 6 programme on composite materials not only epitomises the importance of the Centre but also provides 'the icing on the cake' for what has been a very productive decade of high profile research contracts and partnerships. The FP6 programme is in collaboration with Airbus (UK) and will focus on technology to support the introduction of 'all composite' wing structures – clearly an application of considerable interest to the Welsh economy. The composite programme supplements existing work with Airbus in the Centre on landing gear steels. It is also the second major FP6 programme recently gained.
The earlier programme in collaboration with the European Space Agency, is focussing on titanium aluminides. These are exciting materials with a density half that of steel, a stiffness approaching steel and a temperature capability that competes with advanced nickel alloys. These materials clearly have a huge potential for applications in high performance, light weight structures (see the article on IMPRESS for further details).

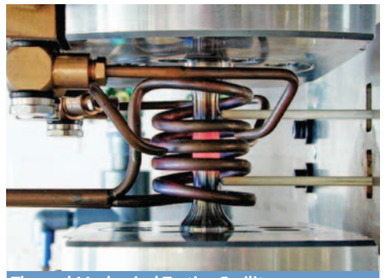
These are prestigious contracts but even more significantly the MRC is the home of a Rolls-Royce University Technology Centre (UTC) in Materials. The UTC model is a unique concept established by Rolls-Royce plc with the aim of harnessing key academic expertise in the support of gas turbine technology. To date more than 20 UTCs have been established within the UK and elsewhere covering most engine technology requirements.

The UTC at Swansea is a key member of a Partnership with the Universities of Birmingham and Cambridge. The mission of the Partnership is to address front-line materials requirements and to ensure that Rolls-Royce engines remain competitive over a rolling 10-20 year time frame.

The UTC is hugely beneficial to Swansea. It is the focal point for postgraduate research and currently supports 14 postgraduate students at Engineering Doctorate (Eng.D.), Ph.D. and Masters (M.Res) level. These students work closely with Rolls-Royce engineers and even, in the case of the Eng.D. programme, are based in the Company. The UTC has the stability offered by a rolling 5 year funding commitment from the Company to support the students. However, it is also the 'pump primer' for access to major research contracts involving the DTI, EPSRC and other industrial partners. Such involvement currently funds 5 senior research assistants and a technician.
This year alone three major contracts have been gained with a combined value of well over one million pounds and aimed at promoting the more efficient and environmentally friendly operation of gas turbine engines.

Current research activities encompass:

- The development of abradable linings that seal the gap between the rotating blades and static casings to improve efficiency and reduce emission of environmentally damaging gases.
- Characterisation and prediction of fatigue in critical single crystal nickel blades for high pressure turbines to support improved performance and longer service lives.
- Development of an advanced life prediction modelling capability to support the high temperature operation of titanium alloys.
- Simulation of the combined thermal and mechanical cycles experienced by 'hot end' components through a unique testing facility (see figure).



Thermal Mechanical Testing Facility

- Characterisation of innovative powder metallurgy methods for advanced titanium alloy structures.
- Controlled microstructures in components to meet conflicting fatigue and creep requirements.
- Aluminium and copper cable technology and advanced composite materials to support power generation for a 'more electric' design of aircraft.

Clearly the Materials Research Centre at Swansea is a major player in the Aerospace arena. Major initiatives currently underway will ensure that this remains the case for the foreseeable future.

For further information please contact: Professor John Evans, Tel: 01792 205678, Email: irc@swansea.ac.uk

Opportunities to find OVERSEAS PARTNERS

The Wales Innovation Relay Centre (WRC) is offering companies and academics across Wales the opportunity to participate in the following sector specific events.

In each case an electronic catalogue of Technology Opportunities will be created and participants will pre-book selected meetings before travelling.

The WIRC can offer 50% funding towards flights and hotel accommodation for SME companies and academics – or can offer to represent you at no cost.

WINTERSPORT EVENT – 2nd and 3rd MARCH 2006 – TURIN, ITALY

Technology partnering meetings in the following fields:

- Advanced materials for winter sport equipment
- Advanced textiles for winter sport clothing
- Technologies for telecommunications, localisation, safety and rescue applications in mountain sports
- Specific equipment and devices for practice of paralympic sports and use of disabled people in general

FUTURE MATCH – 9th-11th MARCH 2006 – HANNOVER, GERMANY

This event runs alongside CEBIT 2006, the world's leading fair for information and communication technologies.

Any company involved in the IT sector would benefit from participating

BIOWALES – 23rd and 24th MARCH 2006 – VALE OF GLAMORGAN HOTEL, WALES

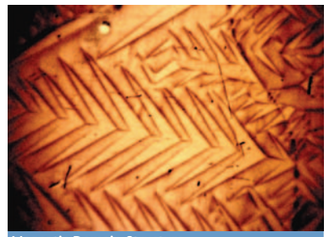
The event will run over 2 days and will showcase and raise awareness of the Welsh bioscience sector to a commercial and academic audience, attracting world-class speakers, researchers and companies.

Companies and researchers from around Europe will be attending and welcome the chance to meet with potential Welsh partners through the technology partnering sessions.

Full details of all these events can be found on the home page of the WIRC web site www.walesrelay.co.uk

Nanomagnetism – the way of the future

Cardiff University is creating an internationally leading centre for research in Magnetics that is positioned to tackle important research challenges of the 21st Century. The Wolfson Centre for Magnetics is establishing a new research programme in 'Nanostructured Magnetic Materials'.



Magnetic Domain Structure

Much of the motivation for developments in nanomagnetism comes from the data storage sector of the economy. There seems to be a never ending demand for increased data storage densities and reduced access times. Unlike the related field of electronics, which has seen enormous investment particularly in microelectronics over the last 50 years, the investment in Magnetics has been relatively modest, with at present only two dedicated Magnetics centres in the UK. The Magnetics industry worldwide is approximately equal in size to the Electronics industry, and nanostructured magnetic materials have the potential to generate major new markets in a wide range of technology areas (e.g. data and information storage, permanent magnets, print industry, nonvolatile memory, industrial sensors and clinical applications). It is estimated that the markets for nanostructured magnetic materials will reach US$12 billion by 2009 and, in terms of final product value, the current global disk drive market, which is totally dependent on nanostructured magnetic materials, is worth circa US$50 billion. However, within the higher education sector in the UK there is in general a lack of capacity in Magnetics when compared with Electronics, and in particular in nanostructured magnetic materials. This has resulted in difficulties in recruitment and retention of staff nationally, and a lack of critical mass and research leadership.

The establishment of a leading centre conducting research and development on nanomagnetism addresses a national need to reinvigorate research activity in this area of knowledge within the UK. The nanomagnetism research activities within the Centre will be structured around the following main themes: (a) amorphous and nanocrystalline magnetic wires, (b) nanostructured spintronic materials, including magnetic tunnel junctions and magnetic semiconductors, (c) amorphous and nanocrystalline films for magnetic sensors, (d) nanocomposite soft magnetic thin films for high frequency wireless communications applications, (e) magnetic nanostructures and particles for medical applications and (f) theoretical modelling of nanoscaled magnetic structures.

The new research is aimed at addressing these issues and will make a major impact on the field of nanostructured magnetic materials through: (1) providing leadership in the field of Magnetics within the UK and Europe by pursuing a programme of both fundamental and applied research on nanostructured magnetic materials, (2) delivering trained scientists and engineers in the field of Magnetics for both UK industry and academia, (3) continuing the development of Cardiff School of Engineering as an internationally leading centre for research, (4) expanding Magnetics as a strategic academic discipline within Wales and, more broadly, the United Kingdom, and (5) building on the Wolfson Centre's reputation in knowledge transfer to provide an opportunity for local and national industry to benefit from the new expertise in Wales and exploit the new technologies in their own businesses.

In order to attract the necessary expertise and establish a critical mass, the University has already allocated funding for new posts in Magnetics in 2005-06. The University has recognised the importance of recruiting the highest calibre of researchers, and to that end has appointed a new team of researchers including three new academic staff. Already one of the planned appointments supported by the University for January 2006 is in the area of nanostructured magnetic materials, and there will be continuing investment by the University that will directly support and benefit the work under this proposal. The Wolfson Centre has a current 5 Year Strategic Plan which will result in a team of ten full time academic positions in Magnetics along with an increase in total research personnel in the Wolfson Centre from 25 to 60.

For more information contact Professor David Jiles, Director, Wolfson Centre for Magnetics, School of Engineering, Cardiff University, CF24 3AA. Phone: 029 2087 6729, Fax: 029 2087 5938, Web: www.cardiff.ac.uk/engin/research/wolfson

DIARY DATES

7th FEBRUARY 2006 6pm
Nano Technology
VENUE: Nanotechnology Centre, UWS
ORGANISER: South Wales Metallurgical Society
CONTACT: Dr Laura Baker
Tel: **01633 755187**
Email: **laura.baker@corusgroup.co.uk**

14th FEBRUARY 2006 10am
Organic Coating Environment & Health Issues in the Automotive Industry
VENUE: Birmingham Medical Institute
ORGANISER: Institute of Metal Finishing
Email: **exterhouse@instituteofmetalfinishing.org**

14th FEBRUARY 2006
Royal Academy of Engineering Lecture Airbus A380
VENUE: Swansea
ORGANISER: Royal Academy of Engineering
CONTACT: Anne Davies
Tel: **01792 295866**
Email: **a.e.davies@swansea.ac.uk**

23rd FEBRUARY 2006 6.30pm
Aluminium Recycling
VENUE: University of Liverpool
ORGANISER: Liverpool and North Wales Materials Society
CONTACT: Tim Bullough
Tel: **0151 794 5399**
Email: **timbull@liverpool.ac.uk**

2nd MARCH 2006 9.45am
Concorde at Filton Site Tour
VENUE: Airbus, Filton
ORGANISER: Materials Network Wales
CONTACT: Penny Woodman
Tel: **029 2082 8631**
Email: **penny.woodman@wda.co.uk**

15th MARCH 2006
Surface Finishing
VENUE: NEWI, Wrexham
ORGANISER: Materials Network Wales
CONTACT: Penny Woodman
Tel: **029 2082 8631**
Email: **penny.woodman@wda.co.uk**

23rd MARCH 2006 7pm
Conventional Breaking Technology
VENUE: Ebbw Vale RFC
ORGANISER: Ebbw Vale Metallurgical Society
CONTACT: Brian Baker
Tel: **01495 334230**
Email: **EVMS_IofM@corusgroup.com**

27th MARCH 2006 6.30pm
SuperSTEM – A Bottom-up View of the Materials World
VENUE: University of Liverpool
ORGANISER: Liverpool and North Wales Materials Society
CONTACT: Tim Bullough
Tel: **0151 794 5399**
Email: **timbull@liverpool.ac.uk**