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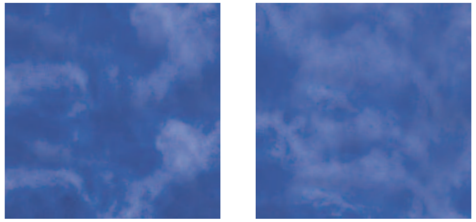
LATEST2

LIGHT ALLOYS TOWARDS ENVIRONMENTALLY SUSTAINABLE TRANSPORT: 2ND GENERATION



2013

SUMMER ISSUE

EPSRC

Engineering and Physical Sciences Research Council

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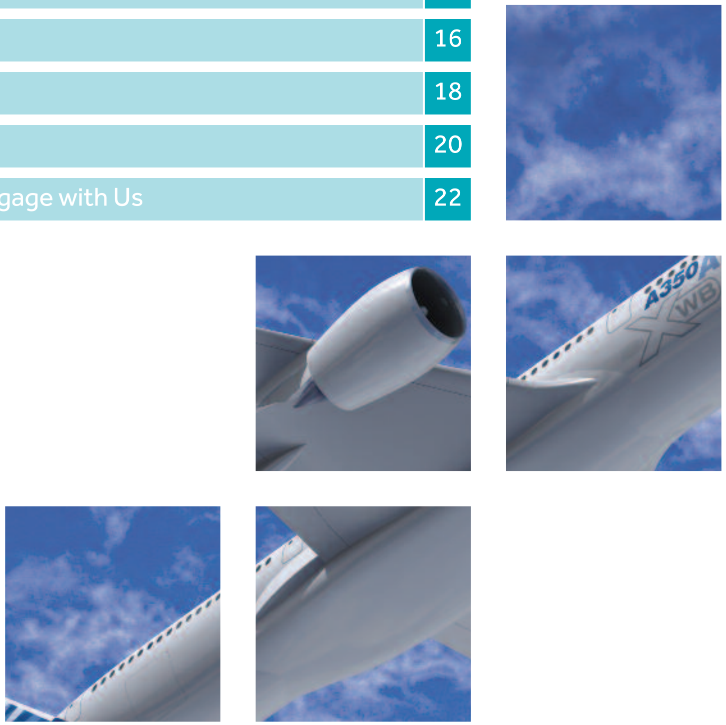

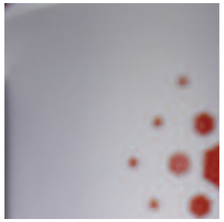

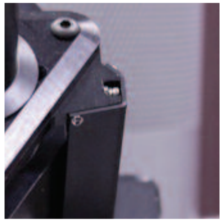

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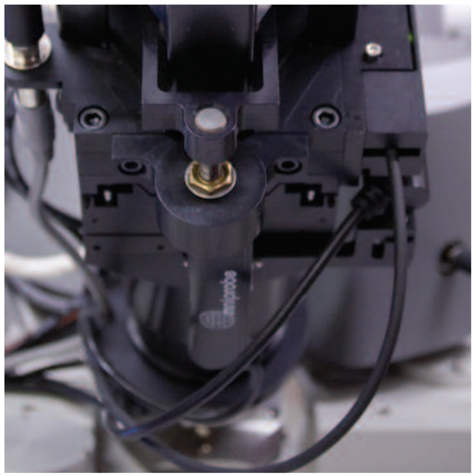


WELCOME

Welcome to the Summer 2013 Issue of the EPSRC LATEST2 (Light Alloys Towards Environmentally Sustainable Transport: 2nd Generation) Newsletter, which provides an insight into the developing interdisciplinary light weight multi-materials research taking place within the School of Materials at The University of Manchester. I look forward to sharing future advances in both our research and outreach activities in forthcoming editions.

The LATEST2 Programme has gained a great deal of momentum since the previous edition of the Newsletter with over 115 research projects now contributing to the Programme. A large number of researchers are undertaking research on the Programme at PhD and Postdoctoral levels. On behalf of the whole of the LATEST2 Management Team, I would like to warmly welcome all new additions to the LATEST2 Team and thank those that have moved on for their contributions to the Programme. A couple of the latter are profiled in this issue.

As part of our commitment to knowledge transfer and our "IMPACT" strategy, in 2013, the team has hosted a number of seminars, workshops and conferences on relevant research topics. One of the most recent events is featured in The Conference Corner later in this issue. These activities have helped strengthen collaborations with existing partners and identify new opportunities and key stake holders to help drive the research and the industrial impact forward.

To date, LATEST2 has also hosted almost 30 scientific visitors from Australia, Chile, China, Colombia, Czech Republic, Egypt, Germany, Italy, Japan, Pakistan, Spain and South Korea.

LATEST2 has also made an "IMPACT" since launch on over 22,000 pupils and members of the general public achieved through an extensive outreach programme. The outreach team has participated in over 50 major events including Science Fairs, Summer Schools, as well as a whole host of School and College visits. Some examples of these activities are featured in the IMPACT News article later in this issue.

Are you interested in collaborating or finding out more about LATEST2? Please visit our website at **www.manchester.ac.uk/latest2**

George Thompson

Professor George Thompson
Programme Director /
Principle Investigator / Theme Leader
EPSRC LATEST2 Programme Grant

RESEARCH IN FOCUS

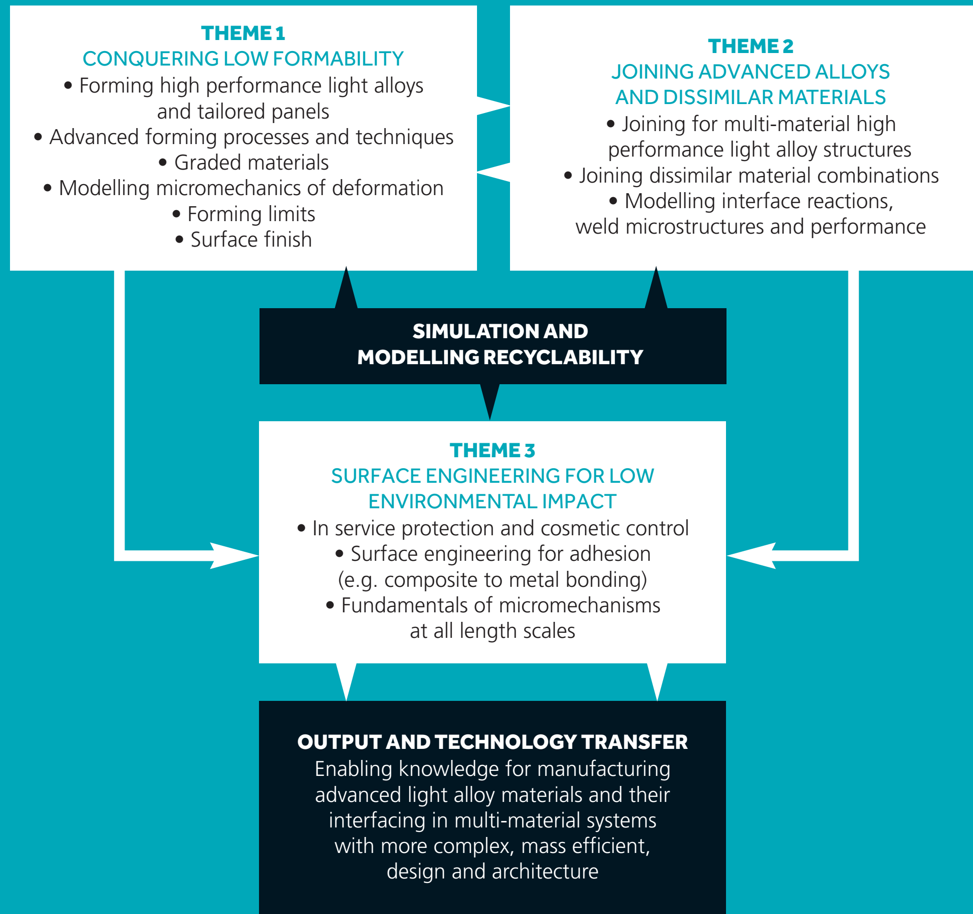
The investment in the LATEST2 Programme Grant is expected to exceed £9 million over a 5.5 year period, including initial funding of £5.6 million from the EPSRC supplemented by a £1million investment from The University of Manchester and pledged leveraged funding from our industrial partners. The LATEST2 Programme aims to facilitate a step change in weight reduction in transport, by developing the science base required to overcome critical issues inhibiting progress towards second generation, lightweight, multi-material designs. We hope to accelerate the exploration of new, transformative, low energy, environmentally-compliant manufacturing processes, by providing solutions to the important materials challenges and predictive capabilities required by industry. This will require the development of an enhanced fundamental scientific understanding and modelling capabilty in key areas.

The research is supported by exciting new approaches to materials analysis, modelling and simulation to facilitate more rapid industrial optimisation and is advanced through three principal interacting themes as illustrated.







SEEING IS UNDERSTANDING

Dr João Quinta da Fonseca
LATEST2, School of Materials
The University of Manchester

Understanding formability by observing deformation at the microstructural scale

An important part of understanding formability is studying the mechanisms of deformation at the microstructural scale. Traditionally this has been carried out by post-mortem analysis of deformed samples using TEM and more recently EBSD. Although this provides useful information, it can only show the remnants of deformation, leaving one to speculate about the actual deformation mechanisms. At Manchester we have developed a new technique that makes it possible to measure strain with sub-micron resolution [1]. This approach relies on the deposition of a very fine gold pattern, which is then imaged during deformation and analysed using digital image correlation (DIC). In LATEST2, this technique has now been used to study two fundamental issues in the formability of light alloys: deformation around particles in aluminium and strain localisation and twinning in titanium.

The deformation around particles in aluminium is important for formability in two ways. Particles are fundamental for microstructure control during processing as they act as preferential sites for recrystallization and help randomize the texture, which improves formability. At the same time, particles are also preferential sites for void nucleation during failure. Lawrence Ko, a PhD student in LATEST2, used high-resolution digital image correlation (HRDIC) to study the deformation around small particles during plain strain compression. The results of these experiments, shown in Fig. 1, revealed that deformation is highly discontinuous in nature, making the interaction between deformation and particle sensitive to particle size, shape and orientation, aspects of which cannot be captured using current continuum models. The unique data we can obtain with this approach will be used to develop new models for deformation around particles in aluminium alloys, which can be used to improve recrystallization predictions in an industrial context.

The formability of hexagonal metals like titanium and magnesium is difficult to understand due to their inherent mechanical anisotropy, which evolves rapidly during deformation because of twinning. Furthermore, twinning and strain localization are important to ductility. For example, it is known that adding aluminium to titanium increases its strength but decreases ductility, probably because it leads to more slip localization and less twinning. During his final year undergraduate project, Albert Smith used HRDIC to observe twinning in-situ and to unravel the details of this important mechanism. As can be seen in Fig 2., this new approach allows us to measure the strain during twinning inside individual grains and quantify slip localization. This work, part of the PhD project of Arnas Fitzner and sponsored by TIMET, aims to explain the effect that Aluminium and other common alloy additions have on these mechanisms and help develop new, stronger alloys, with higher ductility and improved formability.

[1] Fabio Di Gioacchino and João Quinta da Fonseca. 2013. "Plastic Strain Mapping with Sub-micron Resolution Using Digital Image Correlation." Experimental Mechanics 53 (5): 743–754

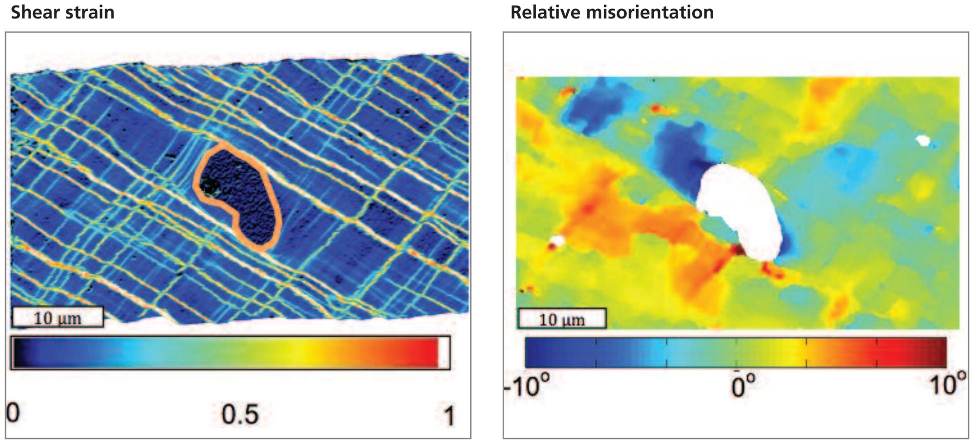


Fig. 1 a) Shear strain around a Si particle in an Al-0.1Si alloy and b) corresponding EBSD map of relative misorientation. Deformation is clearly heterogeneous at the microstructural scale, and the rotations of the lattice are affected by the intensity, density and curvature of the slip bands.

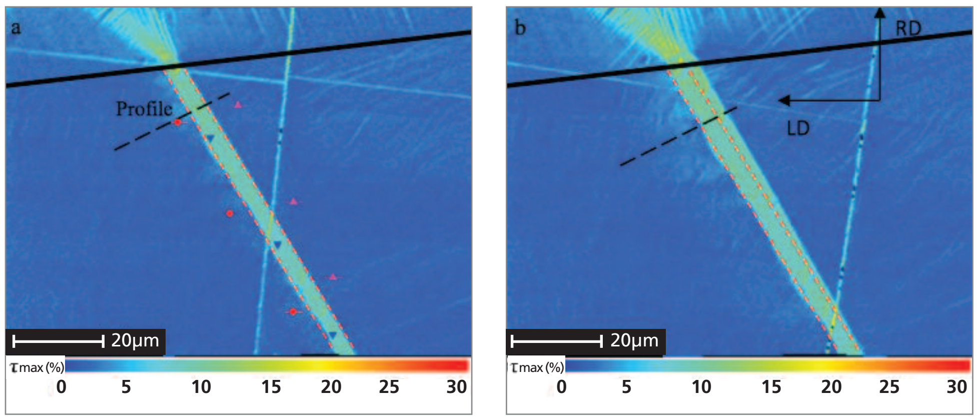


Fig. 2 Strain maps obtained during the twinning of a Ti-2Al alloy. In a) a 65° compression twin can be seen surrounded by a matrix of zero strain, indicating a hard oriented grain. The map clearly shows the high levels of strain generated by twinning and the deformation in the grain above where the twin impinges. b) shows the strain map moments after, clearly illustrating how deformation in this grain occurs primarily by twin thickening.

METAL COMPOSITE JOINING

Professor Philip Prangnell and Mr Andre de Olivera
LATEST2, School of Materials
The University of Manchester
EADS, Innovation Works, Filton, UK

Future airframe designs will increasingly involve the use of high performance composites, however, metallic materials will still feature strongly, particularly where higher temperatures and multi-axis loading are experienced. Unfortunately, because of their very different chemical and physical properties, joints between metals and composite components are often problematic and there is thus a need to improve their efficiency and longevity.

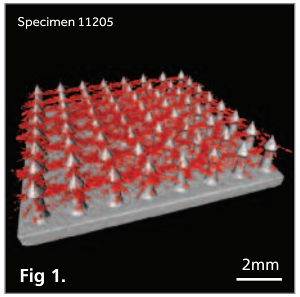
Conventional methods of composite metal joining include mechanical fastening and adhesive bonding. Recently, a new class of joints has emerged in which both mechanical and adhesive bonding elements are integrated into the design. With this approach, locking features are engineered on to the metal part that are embedded into the composite to increase shear load transfer, via both better adhesion and mechanical 'fit', through the thickness of the laminate. Such hybrid joints have become known collectively as 'hyper-joints' and can greatly improve the shear transfer and joint failure energy.

A typical hyper-joint design involves manufacturing arrays of small pins (typically ~ 1 mm diameter) on a titanium substrate (Fig. 1). Approaches that have been explored to date, for creating hyper-pin arrays, include electron beam surface sculpting (Surfi-Sculpt®) attachment of wire pins by GMAW-cold metal transfer welding (CMT) and laser additive manufacture (AM). Such methods can have drawbacks including, restrictions in the pin shape (Surfi-sculpt and CMT) and a slow production rate (AM). In collaboration with EADS Innovation Works, LATEST2 has been investigating the metallurgical issues associated with such approaches for manufacturing hyper-pin arrays in titanium; including the critical area between the base of the pins and component substrate (Fig. 2) where there is usually a sharp microstructural gradient. We are also investigating the potential of new techniques for attaching pre-shaped forged pins, with the aim of achieving better consistency of the pin shape and failure load and higher production rates.

Methods are being developed to test and model the performance of individual pins (Fig.3), as well as to study the damage that develops in a laminate joint assembly under load using the 3-D imaging X-ray Computed Tomography (XCT) facilities in the Manchester X-Ray Imaging Facility (MXIF).

Within Theme 3 on surface engineering, work is also on-going to understand, at a fundamental level, how to better tailor surface oxide pore structures to improve adhesion on the metal surfaces. For example, in Fig. 4 a transmission electron micrograph is shown of an anodic film formed where anodizing was performed initially at an increased voltage to generate a more open porous structure, for improved adhesion, and then subsequently at a reduced voltage to generate a finer more regular porous morphology tailored to improve corrosion resistance.

Acknowledgements:
Rotimi Oluleke (EADS-LATEST2 PhD Student)
Dr. Fabien Leonard (MXIF)



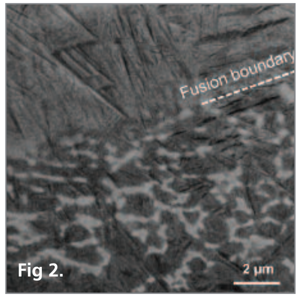
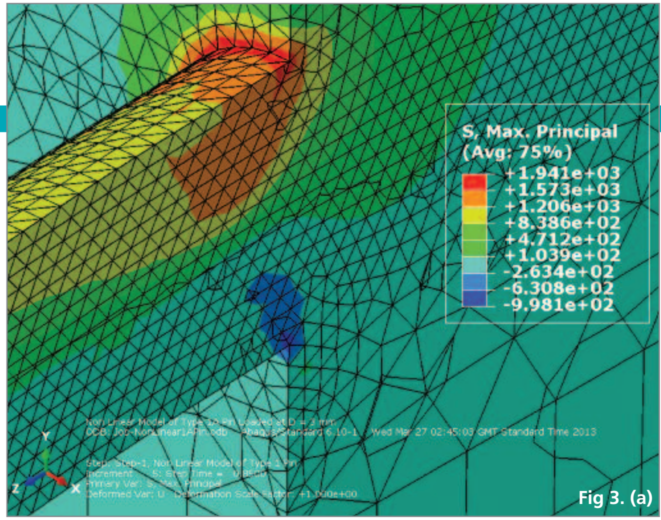
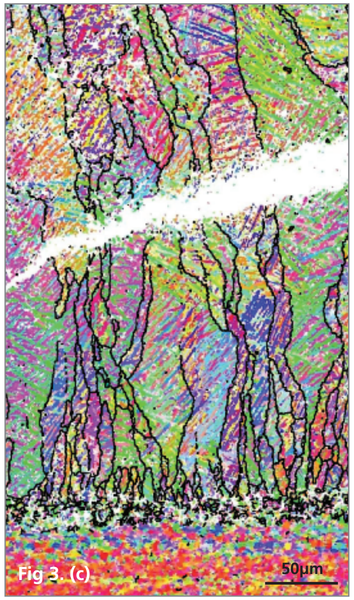


Fig. 1 X-ray microtomography image showing the hyper-pin array in a loaded lap joint with the development of damage in the composite indicated in red.

Fig. 2 High resolution SEM image showing the microstructure variation across the melt pool fusion boundary of a 'welded on' hyper-pin with a Ti64 rolled plate substrate.





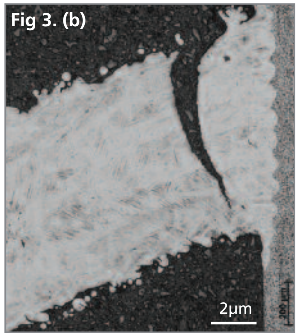


Fig. 3 (a) FE model of an individual hyper-pin under shear load, and cracking in LSM additive manufactured pin during shear testing, **(b)** optical image and **(c)** α phase EBSD map, with prior β grains outlined.

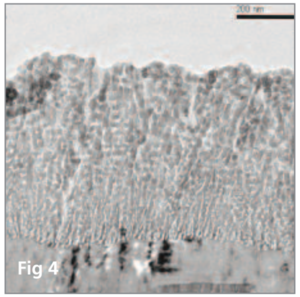


Fig. 4 Transmission electron micrograph of an anodic film with a tailored pore structure, formed in sulphuric acid/tartaric acid on an aluminium AA2024 alloy. Anodizing was performed initially at increased voltage to generate an open porous structure, for improved adhesion followed by a reduced voltage to generate a finer pore for improved corrosion resistance.

Dr Michele Curioni and Professor George Thompson
LATEST2, School of Materials
The University of Manchester

Electrochemical testing coupled with real time imaging provides a new tool for practical assessment of anticorrosion performance

There is general agreement that industrial accelerated corrosion tests such as Salt Spray Test (SST) and others are not always adequate to evaluate real-life performance. The source of concern is that accelerated tests rely on a particularly aggressive environment to reduce the time to failure. Thus, corrosion mechanisms that would never be present under real-life conditions could be initiated and cause failure. Further, the output of such tests is generally expressed as pass (no corrosion) or reject (unacceptable corrosion) and little or no information on the time-evolution of the corrosion process is obtained.

On the other hand, electrochemical tests, more common in Academia, rely on measuring the response due to an externally applied voltage or current of an immersed corroding surface. They are fast and provide fundamental information on the corrosion processes but it is debated if they are representative of the real-life behaviour due to the electrical perturbation of the corroding surface. Further, they are generally not standardized and difficult to standardize, since the optimum test parameters depend on the material-environment combination; optimization and interpretation requires a well-trained operator.

Electrochemical Noise Analysis is unique among the electrochemical techniques because it does not require the application of probing signal to the corroding surfaces. In practice, two nominally identical specimens are immersed in a test solution and electrically connected through an external circuit. As a result of corrosion on the surfaces, current and potential fluctuations are detected and recorded. The theory behind the interpretation of the electrochemical noise signal is well established, but relatively complex. For this reason, a specific software package has been recently developed and distributed online (Fig 1). The package requires minimal user knowledge and estimates electrode impedance (inversely proportional to corrosion rate), average charge (proportional to volume of material corroded) and frequency of corrosion events, as a function of exposure time.

Data obtained from electrochemical noise measurements are intrinsically representative of a freely corroding system because no probing signal is applied. Further, the use of ready-made software to extract relevant, time-dependent, corrosion-related quantities, does not require detailed understanding of the underlying theory (Fig 2). For these reasons, the method is an ideal candidate to be standardized (by standardizing the test environment) and to provide simultaneously quantitative fundamental and practical performance data.

Being an immersion test, as an added benefit, the surface of the specimens can be imaged in real time and image-analysis techniques and accelerated footages can be used to highlight the details of corrosion initiation and propagation (Fig 3). The two combined approaches, automated electrochemical noise analysis and associated surface imaging provide a new intuitive, low cost and robust tool for the comparative evaluation of the corrosion performance of protective treatments, inhibitors and paints. A stand alone cabinet, capable of simultaneously recording and analysing the electrochemical noise signal and the surface appearance of the corroding specimens has been recently developed. Direct comparison of images and time-lapse video allows a rapid identification of the best candidate treatment between competing solutions. Consideration of the values of low-frequency noise impedance provides quantitative estimation of the anticorrosion performance. Once finalized and commercially available, it will be a powerful tool for both fundamental and applied corrosion studies, enabling reliable information to be obtained without requiring a highly trained operator.

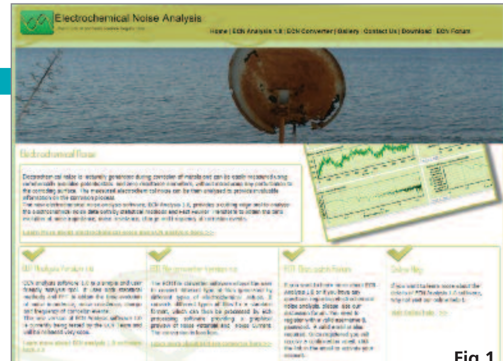


Fig 1.

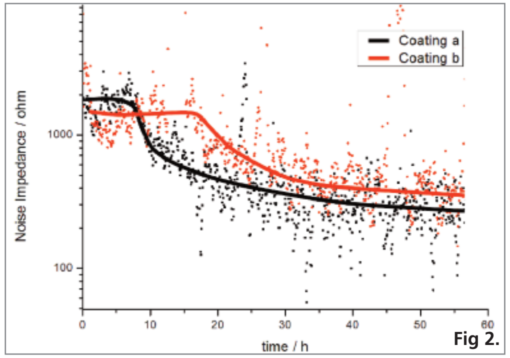


Fig 2.

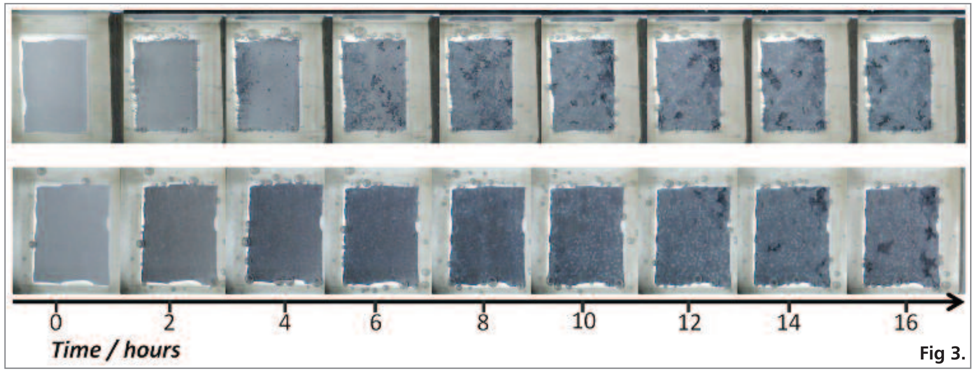


Fig 3.

Fig. 1 Homepage of the website where the electrochemical noise analysis software can be downloaded (www.electrochemicalnoise.com)

Fig. 2 Time evolution of the low-frequency noise impedance for two ZE41 magnesium alloy specimens supporting oxide coatings obtained by plasma electrolytic oxidation; a) 10 mA and b) 20 mA for 10 min, corrosive electrolyte: 3.5% NaCl. High values of impedance indicate low corrosion rates, low values of impedance indicate that corrosion is propagating, rapid decrease indicates corrosion initiation. Lines are intended as a guide to the eye.

Fig. 3 Images acquired during corrosion of ZE41 magnesium alloy supporting oxide coatings obtained by plasma electrolytic oxidation; a) 10 mA and b) 20 mA for 10 min. Red arrows indicate the first sign of coating failure (4h and 12h respectively), corrosive electrolyte: 3.5% NaCl.

RECENT PUBLICATIONS

The effect of a paint bake treatment on joint performance in friction stir spot welding AA6111-T4 sheet using a pinless tool
Y.C. Chen, S.F. Liu, D. Bakavos, and P.B. Prangnell
Materials Chemistry and Physics
141 (2-3) 768-775 (2013)

In situ observation of texture and microstructure evolution during rolling and globularization of Ti–6Al–4V
J.L.W. Warwick, N.G. Jones, I. Bantounas, M. Preuss, D. Dye
Acta Materialia 61 1603-1615 (2013)

Effect of fluoride ions on plasma electrolytic oxidation of AZ61 magnesium alloy
A. Němcová, P. Skeldon, G.E. Thompson, B. Pacal
Surface Coatings Technology 232 827-838 (2013)

The effect of beta phase on microstructure and texture evolution during thermomechanical processing of alpha + beta Ti alloy
D.G. Leo Prakash, P. Honniball, D. Rugg, P.J. Withers, J. Quinta da Fonseca, M. Preuss
Acta Materialia 61(9) 3200-3213 (2013)

The effect of beta grain coarsening on variant selection and texture evolution in a near-beta Ti alloy
G.C. Obasi, J. Quinta da Fonseca, D. Rugg and M. Preuss
Materials Science and Engineering A 576 272-279 (2013)

Constituent particles and dispersoids in an Al-Mn-Fe-Si alloy studied in three-dimensions by serial sectioning
J. Robson, J. Quinta da Fonseca, L. Dwyer, T. Hashimoto, G. Thompson, N. Kamp
Materials Science Forum, 765, 451-455 (2013)

Plasma electrolytic oxidation of coupled light metals
A. Baron-Wiechec, M. Curioni, R. Arrabal, E. Matykina, P. Skeldon, G. E Thompson
Transactions of the Institute of Metal Finishing 91(2) 107-112 (2013)

Microstructural modification arising from alkaline etching and their effect on anodizing behaviour of Al-Li-Cu alloy
Y. Ma, X. Zhou, G.E. Thompson, X. Zhang, C. Luo, M. Curioni and H.J. Liu
Electrochemical Society 160 C111-118 (2013)

Coating development during electroless Ni-B plating on magnesium and AZ91D alloy
E. Correa, A.A. Zuleta, L. Guerra, M. A. Gómez, J.G. Castaño, F. Echeverría, H. Lui, A. Baron-Wiecheć, T. Hashimoto, P. Skeldon and G.E. Thompson
Surface Coatings Technology 232 784-794 (2013)

The effectiveness of surface coatings on preventing interfacial reaction during ultrasonic welding of aluminum to magnesium
A. Panteli, J.D. Robson, Y.C. Chen and P.B. Prangnell
Metallurgical and Materials Transactions A DOI: 10.1007/s11661-013-1928-z (2013)

Extending the life of light alloy components: microstructure, corrosion, inhibition and performance assessment
M. Curioni, A.C. Balaskas, T. Hashiomoto, A.I. Egbeolu, and G.E. Thompson
Materials Science Forum 765 597 (2013)

Microstructural modelling for friction stir welding of high strength aluminium alloys
J. Robson, L. Campbell
Materials Science Forum 706 1008-1013 (2012)

Modelling intermetallic phase formation in dissimilar metal ultrasonic welding of aluminium and magnesium alloys
J. Robson, J.A. Panteli, P. B. Prangnell
Science and Technology of Welding and Joining 17(6) 447-453 (2012)

RESEARCHER PROFILES

Dr Aleksandra Baron-Wiechec
Physicist in Culham Centre for Fusion Energy (UKAEA), UK

After completing my PhD, my scientific career began when I obtained a position as assistant professor at the Silesian University of Technology in Gliwice, Poland in 2005. I was involved in a project focused on an investigation of the relationship between structure and thermal crystallization process of amorphous soft magnetic Fe-based alloys and their magnetic features along with corrosion behavior.

I first joined the School of Materials at The University of Manchester in 2008 as a Marie Curie Fellow (IEF for Career Development, FP7). During my time at Manchester, I was a frequent user of the Van de Graaff accelerator at the Université Pierre et Marie Curie in Paris, where I used a wide range of Ion Beam Analytical techniques to study the mechanism of anodizing of aluminium. Thanks to the project I got an opportunity to perform unique multidisciplinary experiments at the leading edge of electrochemistry and nuclear physics.

After finishing my Marie Curie fellowship in 2010, I was privileged to join the EPSRC LATEST2 Programme Grant and continued my scientific adventure within a vibrant environment created by LATEST2 Team. Thanks to the project's research plan and availability of a variety of equipment I gained invaluable hands-on experience in conducting experiments in electrochemistry and materials/surface science. Thanks to the great knowledge of my supervisors and very helpful colleagues within the LATEST2 team, I have gained not only hands-on experience but also new, and more importantly, transferable skills. I feel fortunate to take these important lessons with me. This combined experience gave me very welcome confidence for moving to Culham Centre for Fusion Energy (CCFE) and being successful as an independent scientist in a demanding environment.

The Culham Centre for Fusion Energy (CCFE) hosts the world's largest magnetic fusion experiment JET (Joint European Torus), on behalf of its European partners. The JET facilities are operated for scientists from around Europe, co-ordinated by the EFDA-JET Close Support Unit (under the European Fusion Development Agreement). I work in the R&D Experimental Department and my work includes responsibility for a wide range of surface analysis techniques for measurements of elements extracted from the JET tokamak, development of links with the UK and overseas universities to encourage participation in exploitation of JET data, and also assistance in operation of some of the JET diagnostics during plasma campaigns.

Ian Brough
Electron Optics

My career in science began in 1956 when I signed on for a 5 year technician apprenticeship in the research laboratories of the now defunct local engineering firm in Stafford where I was born. In my final year I was introduced to transmission electron microscopy and became immediately infatuated by an instrument opening up a whole new world with a claimed resolution of 1nm (although nanometres hadn't even been conceived at that stage) .

By a twist of fate in1964 I applied for a job as an EO in charge of a TEM at Manchester College of Science and Technology in the newly formed Metallurgy Department under the leadership of Prof K.M. Entwistle. To my surprise I was appointed and was fortunate to work with the late D. A. Ryder, newly arrived from RAE Farnborough. Dennis had a passion for fracture and failure investigation and taught me how to read and analyse fracture surfaces. In those days all high resolution fractography was carried out on the TEM using replicas.

In 1974 the metallurgy departments of the University and what was now called UMIST amalgamated and moved to the current location on Grosvenor Street.

I now found myself working with another talented and passionate microscopist, Gordon Lorimer from whom I learned a tremendous amount. My colleagues Graham Cliff and later Peter Kenway were both TEM orientated so I eventually gravitated towards SEM which was now becoming a useful tool for chemical analysis as well as fractography.

In 1987, I was involved with organising EMAG at Manchester and met John Humphreys from Imperial College for the first time. To my surprise John was appointed to replace the retiring Prof Entwistle and arrived in Manchester with a very primitive early EBSD system. I was immediately gripped by the ability to obtain diffraction patterns and orientations from single grains of metallic materials even though interpretation relied mainly on pattern recognition and operator skill and was completely manual. That was the beginning of a long and for me very fruitful collaboration with John whom I assisted in developing the technique to the powerful quantitative tool which it is today.

In 2002, I retired from my position as Manager of the Electron Optics and X-Ray facility and was fortunate to continue to work with Prof John Humphreys on a part-time basis on the EPSRC funded LATEST Portfolio award and subsequently LATEST2 Programme Grant. I continued development work on EBSD and contributed to the advanced research being undertaken within the LATEST team. Very importantly I shared my knowledge and helped train up and coming LATEST2 researchers whilst enjoying the developments in high resolution scanning electron microscopy which were taking place.

Although I have not lost the passion for electron optics I decided that it was finally time to put away my tweezers in December 2012 having enjoyed my 48 years in The University of Manchester and been extremely privileged to work with a large number of hugely gifted and talented researchers of

IMPACT NEWS

The LATEST2 team has been involved in a wide variety of outreach events in 2013, ranging from visiting local schools to hosting work experience students and participating in major science events. This article highlights two of our recent key initiatives.

LATEST2 Residential Engineering Materials Summer School

This is the 6th year that the LATEST and more recently the LATEST2 Residential Engineering Materials Summer School has taken place. This year, due to overwhelming demand for places, for the first time we ran two Summer Schools during July 2013.

The Engineering Materials Summer Schools were attended by over 90 Year 10 and 11 students (aged 14 – 16 years old). During each course, the students stayed at the University for 4 days and took part in a wide variety of talks, practical workshops and social activities, all of which aimed to ignite their interest in engineering and physical sciences, give them an introduction to the different aspects of Materials Science and a taster of university life.

Activities included a practical workshop, in which students worked in teams to try to design and build the stiffest, lightest and most environmentally friendly beam possible, using a range of different materials. This workshop ended with each beam being tested to failure, and the students giving a team presentation. We were very impressed with some of the creative and effective designs the students came up with.

During the course, the students visited the Jaguar Landrover (JLR) manufacturing centre in Halewood, where they were able to see the production line and hear about some of the materials JLR are currently using to build their cars.

Dara O'Briain meets our PhD students taking part in the Cheltenham Science Festival

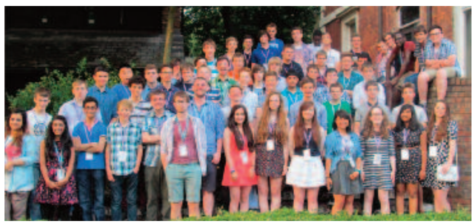
Students were also given talks from a range of academics within the School of Materials and heard about topics such as - the EPSRC LATEST2 research programme, cutting-edge work taking place in the field of nanotechnology and graphene, and how scientists design materials for medical applications.

The Summer Schools were a great success, with one student commenting –

'It was not only a great experience but also a very inspiring week which really got me interested in material sciences, engineering and sciences in general.'

And another student stating that 'I thoroughly enjoyed it and would love to do it again! It was an amazing experience.'

We also received some very positive feedback from the parents of the students who attended, including – 'I think the course is an excellent way for them to have a taster of University and also Materials Science. My son is very keen to do something with engineering after this.'



Students attending the LATEST2 Engineering Residential Summer School 2013

Cheltenham Science Festival

In June 2013, the LATEST2 team took part in the Cheltenham Science Festival. This was the first time that we had been involved in this event, which is one of the UK's largest science festivals, and this year was attended by over 39,000 people.

LATEST2 ran a stand as part of the Discover Zone section of the Festival. The Discover Zone was open every day of the Festival and gave people the opportunity to get hands-on with the science and research taking place at a wide variety of scientific organisations.

The Discover Zone attracted both school students and an adult audience, and the LATEST2 Marvellous Materials stand proved to be a hit with the crowds. We ran a number of interactive activities, including challenging the audience to discover the toughness of their favourite chocolate bars using an impact tester and investigating copper plating by etching designs on steel!

These activities all aimed to raise awareness of Materials Science and to showcase some of the exciting work taking place at The University of Manchester. The Festival was a fantastic opportunity to engage with people of all ages from across the country, and whilst there our stand even got a mention by the Times twitter team! "**@TimesScience**: Exploring the fracture toughness of chocolate- quite a hit with the crowds **#cheltscifest**"

LATEST2 Interactive Stand at the Cheltenham Science Festival

Students take part in the LATEST2 Materials Identification Workshop

THE LATEST2 SCIENCE COMMUNICATION "IMPACT" STRATEGY AIMS TO REACH:

- INDUSTRY
- MATERIAL SCIENTISTS
- PUPILS
- ACADEMIA
- COMMUNITY
- TEACHERS & CAREER ADVISORS

CONFERENCE CORNER

On April 11th 2013, EPSRC LATEST2 Programme and The EPSRC Centre – LiME, co-organised a Light Metals Technology Workshop which was held at Brunel University, which attracted a wide audience including industrial leaders, technical managers and researchers from across the UK. The purpose of the workshop was to identify industry issues and challenges relating to aluminium and magnesium and attracted participants from industry as well as academia, and also featured the re-launch of the IOM3 Casting Division at Brunel University.

Front-line UK research in aluminium and magnesium within the EPSRC LATEST2 research programme at the University of Manchester and at the EPSRC Centre-LiME was highlighted. Exclusive presentations revealed unique aluminium and magnesium perspectives within automotive and aerospace applications and explored the funding opportunities provided by EPSRC and the Technology Strategy Board.

The extended panel-led discussions in the afternoon provided opportunity for discussion and debate on future industry needs and research opportunities for transport applications with a particular emphasis on end-of-life recovery and recycling. Discussion topics included: the future of the alloy design, the need for more magnesium research, UK car recycling and high pressure die-casting research.

EPSRC Portfolio Manager, Dr Tony Chapman, "found the workshop very interesting and useful. It was good to see the good progress being made in the EPSRC LATEST2 research programme and the EPSRC Centre-Lime, as well as lots of interest from industry".

The workshop is one of four major events this year either hosted or co-hosted by the EPSRC LATEST2 team to help build and strengthen the UK manufacturing and research communities, by aligning academic research to help meet industrial challenges.

Dr Xiaorong Zhou, LATEST2 Co-Investigator, The University of Manchester

Delegates visit the LATEST2 Interactive Exhibition

Presentations from researchers from the EPSRC LATEST2 Programme and EPSRC – Centre Lime

Keynote speakers and chairman (left to right) Mr R. Darlington, Prof G. Scamans, Dr J. Robson, Prof Z. Fan, Prof G. Thompson, Dr X. Zhou and Mr M. Jarrett

If you missed the event and you are interested in finding out more then please email **susan.davis@manchester.ac.uk** or visit the LATEST2 website at **www.manchester.ac.uk/latest2**

OPPORTUNITIES TO ENGAGE WITH LATEST2

Opportunities for Industry and Academia

The LATEST2 team is committed to establishing and building long-term strategic partnerships with leading industrial players and other research institutions. We believe in creating mutually beneficial collaborations that provide access to research facilities and expertise for industry together with opportunities to work on real-world problems in the transport sector for academics. Collaboration also enhances our capacity to educate and train the next generation of researchers and highly skilled, knowledgeable professionals for industry.

Your company or institution could become a partner in the LATEST2 research and benefit by taking advantage of the expertise available in the university and its partners.

Sponsor a LATEST2 Student
Your company could take the opportunity to work with experienced graduates who can provide cutting edge research focused on your business needs. By sponsoring a LATEST2 student you would have the opportunity to fund the work of an exceptional student and to encourage research relevant to your industry. The LATEST2 team of Investigators will work with you to match a student with the appropriate skills in your specific industry sector.

You have the option to sponsor a full PhD or a Masters student through their course or to sponsor a dissertation project, lasting five months, during which time an MSc student will carry out academic research on a specific project in your business.

Sponsor a LATEST2 Postdoctoral Researcher
Your company could take the opportunity to work with an experienced Postdoctoral Researcher who can provide cutting edge research focused on your business needs. By sponsoring a LATEST2 Postdoctoral Researcher you would have the opportunity to fund the work of an exceptional researcher and to encourage research relevant to your industry. The LATEST2 team of Investigators will work with you to match a suitable Postdoctoral Researcher with the appropriate skills and expertise in your specific research sector.

LATEST2 Collaborative Research Project
Your company or academic institution could enter into collaborative research with LATEST2, working together on a specific project. Such a collaborative project would combine the expertise of your company or academic institution with that of the LATEST2 team to benefit both parties. Various funding streams may be available to support collaborative research projects and we can provide guidance on tapping into suitable funding streams.

Opportunities for Schools

The LATEST2 team place significant emphasis on visiting schools and welcoming schools to come and visit us, with our researchers and experts giving talks and running workshops which present a wide range of materials issues. Members of LATEST2 have also been invited to give talks to school teachers, pupils and the general public at a variety of events.

Schools from across the country visit The University of Manchester to find out more about future opportunities in science and engineering. Young visitors can explore their potential during engineering open days or gets hands-on experience through initiatives such as the Engineering Development Trust (EDT) 'Headstart' course. In addition a four-day LATEST2 Materials Engineering Residential Summer School is run annually for GCSE students interested in science and engineering who want to have a taste of university life.

If you are interested in pursuing any of these opportunities or finding out a little more then please visit our website at:
www.manchester.ac.uk/LATEST2

LATEST

LIGHT ALLOYS TOWARDS ENVIRONMENTALLY SUSTAINABLE TRANSPORT: 2ND GENERATION

EPSRC
Engineering and Physical Sciences Research Council

LATEST2

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