The Energy Materials Group is an interdisciplinary special interest group of the Institute of Materials, Minerals and Mining.
The UK government has made a commitment to ban the sale of new petrol and diesel cars by 2040. In the wake of the VW emissions scandal on diesel vehicles and increasing concern about air pollution in our cities, this might seem to be a popular move. However, I wonder if much thought has been given to how the rise in the number of electric vehicles (EVs), from less than 1% of new sales today, will be managed from an energy viewpoint. It will be counterproductive if the switch from fossil fuelled vehicles to primary electricity supply will mean that our most carbon intense electricity generation from fossil fuels is kept running for longer to maintain supply. Too rapid a rise in new EV registrations could slow our progress in reducing CO₂ emissions.

The interplay of different energy vectors for electricity supply, transport and heating is complex and is set to become more complex as we increase renewable energy generation on the grid. The energy supply and demand scenarios on the electricity grid will be very different to today with more distributed energy generation, “smart demand”, energy storage and a more dynamic energy pricing to facilitate a balance of supply and demand. On the 30th April the Institute of Welsh Affairs (IWA) will be launching their study on the potential for renewable energy generation in the Swansea Bay City Region as an exemplar of what could be achieved by 2035 to reduce GHG emissions by 80%. This launch will be held at the National Waterfront Museum in Swansea, not far from where the Swansea Bay Tidal Lagoon might or might not be built! Please see the link http://www.iwa.wales/events/harnessing-the-potential-renewable-energy-in-the-swansea-bay-city-region-43307964287/

The challenges presented by a rapid rise in EVs will be the theme of the 2018 Annual Energy Materials Lecture which will be held on the 14th June at 297 Euston Road. This will be given by Professor Nigel Brandon, Imperial College and the title of the presentation will be “Materials for energy storage in electric vehicles and low carbon grids – opportunities and challenges”. We expect this to be a very popular lecture so please book early for a place as numbers will be limited.

Finally, on the theme of EVs, I would like to draw your attention to a conference on Lithium (from exploration to end-user) that will be held at the Geological Society on the 9-10 April. This conference is jointly sponsored by the EMG. With these upcoming events and the growing awareness of the revolution in energy supply, I am looking forward to an exciting year for the EMG. As always, the feedback and suggestions from EMG members is always welcome as we raise the profile of energy materials in meeting these environmental and climate change challenges.

Professor Stuart Irvine
Chair EMG
Materials for energy storage in electric vehicles and low carbon grids - opportunities and challenges

Professor Nigel Brandon OBE FREng FIMMM
Dean of Engineering at Imperial College London, Director of the UK Hydrogen and Fuel Cell Hub, and Co-Director of the UK Energy Storage Hub.

The presentation will discuss the role of energy storage in low carbon transport and low carbon energy systems, with a focus on the material requirements for these applications. Particular attention will be paid to advances and challenges in lithium ion batteries, flow batteries and electrolyser/reversible fuel cells, and will draw on the speaker's own research in these areas.

Registration details available at:
www.iom3.org/emg2018
Energy Materials Information Streams

The EMG microsite is a mine of information relating to Energy Materials with links to various sources of information, including funding sources for collaborative research/development.

The EMG microsite is actively managed and regularly updated; the link to the appropriate location on the microsite is given below


EMG Annual Lecture (www.iom3.org/EMG2018)

Please note the EMG annual lecture to be given by Professor Nigel Brandon OBE, FREng on the subject of materials for energy storage in electric vehicles and low carbon grids – opportunities and challenges, 14th June 2018, 5.30 for 6pm at IOM3 headquarters, 297Euston Rd, London NW1. See flyer next page.

Front Cover

So have you decided what the picture on the front cover is? It's a cross section of a SiC/SiC composite manufactured by the Chemical Vapour Infiltration, CVI, method. The material CERASEP G415 material is characterised by a fibre volume ratio of 40% to 43%, and a bulk porosity of between 3.9% and 6.6%. The material is composed of 2D plain weave Hi-NicalonTM fibre with a CVI Si/C/B multilayer self-healing matrix requiring some 12 plies to produce a 3mm laminate thickness.

Materials Today Energy, Volume 7, March 2018

- Optical rectification through an Al₂O₃ based MIM passive rectenna at 28.3 THz
- Co stabilized metallic 1T₄ MoS₂ monolayers: Bottom-up synthesis and enhanced capacitance with ultra-long cycling stability
- Protecting Al foils for high-voltage lithium-ion chemistries
- Highly efficient Ag₂Se quantum dots blocking layer for solid-state dye-sensitized solar cells: Size effects on device performances
- Hierarchical cobalt oxide-functionalized silicon carbide nanowire array for efficient and robust oxygen evolution electro-catalysis
- Highly active and stable electrocatalytic hydrogen evolution catalyzed by nickel, iron doped cobalt disulfide@reduced graphene oxide nanohybrid electrocatalysts
- Exploiting a hybrid lithium ion power source with a high energy density over 30 Wh/kg
- A cross-disciplinary overview of naturally derived materials for electrochemical energy storage
- The role of grain boundaries in perovskite solar cells

Copies of these and other papers are available at https://www.sciencedirect.com/journal/materials-today-energy/vol/7/suppl/C
Committee Member Profile

Professor Scott Lockyer, Technical Head Materials & Corrosion, Uniper Technologies Limited
(scott.lockyer@uniper.energy)

Short CV
I am a Fellow of IOM3, as well as a Chartered Engineer (CEng), and have been a member of the EMG board since 2014. I also sit on the High Temperature Materials Committee providing an energy materials input into their activities. I am Technical Head of Materials and Corrosion in Uniper Technologies Limited’s (UTG) Integrity and Inspection Solutions Department. My role is to provide technical leadership and oversight of Materials activities such as failure investigation, component life assessment and R&D. I joined UTG in November 2005 following technical management and principal engineer roles in a number of engineering consultancies including TWI Ltd where I was a Principal Project Leader in the Structural Integrity Technology Group managing projects in the areas of fatigue and fracture for the aerospace and oil & gas sectors. Prior to this I was a Research Fellow in the Department of Materials at Oxford University investigating the downstream processing of twin roll cast aluminium alloys. I did my degree in Metallurgy & Materials Science and PhD in Metallurgy at the University of Liverpool graduating in 1988 and 1992 respectively. I was appointed Royal Academy of Engineering Visiting Professor in Advanced Materials at Loughborough University in April 2013 for four years and the University have recently extended this for a further three years. In this role, I provide lectures on topics such as energy materials, welding & joining and failure investigations. I also provide and supervise final BEng and MEng projects.

Materials Interests
The main materials interest is the mechanical behaviour of materials from understanding the influence of microstructure on fatigue performance in my PhD, to the influence of processing on final mechanical properties or the degradation due long term service exposure in power stations. I have been fortunate to have worked on a range of ferrous and non-ferrous metals and alloys. The most challenging but enjoyable part of my role is undertaking (or supporting the team during) failure investigations. Trying to identify the active damage mechanisms and why it has become active is making use of all the skills and experience I have gained in my career so far. In my current role we support a range of power generation assets including wind turbines, coal plants, gas turbines, concentrated solar power, all of which have significant materials challenges

Outside Interests
I love being active and spend as much time as possible outdoors. I regularly run, cycle (mountain biking and on the road), hill walk and try to keep fit. I’m an enthusiastic gardener and although not always successful I do enjoy trying to grow my own fruit and vegetables. I also brew my own beer and very generously subject my friends to the pleasure of drinking it. Most important of all is spending time with my wife and children.
Organisation Profile

EPRI

The Electric Power Research Institute (EPRI), a US based organisation, conducts research, development, and demonstration projects for the benefit of the public in the United States and internationally. EPRI is an independent, non-profit organisation focusing on electricity generation, delivery, and use in collaboration with organisations within the electricity sector.

In November 1965, the Great Northeastern Blackout left 30 million people in the United States without electricity. Although power was largely restored within 12 hours it triggered the creation of the Electric Power Research Institute (EPRI) to provide advice and guidance to the various independent power producers based upon a common interest membership. Today this membership covers approximately 90% of the electric utility revenue generated in the United States and extends to participation in more than 35 countries. The worldwide membership that supports EPRI work comprises more than 1,000 organizations. While most members are electric utilities, others are businesses, government agencies, regulators and public or private entities engaged in some aspect of the generation, delivery, or use of electricity.

Through their advisory roles in EPRI members help formulate the annual research portfolio, identify critical and emerging electricity industry issues, and support the application and technology transfer of EPRI’s research and development. Details of the 2018 research portfolio can be found at https://www.epri.com/#/portfolio/en/2018/home and covers all aspects of power industry from “Water Availability and Ecological Risk” to “Generation Nondestructive Evaluation Research” to “Radiation Safety Program” to “Integration of Distributed Energy Resources” and many more. With regard to energy materials there are numerous projects e.g. “Weld Repair of Conventional CrMo Steels to New Code Requirements”, “Development of metallurgical risk factors for creep strength-enhanced ferritic (CSEF) steels and welds” or “Superheater Outlet Header: Validation of Fitness for Service Methodologies”.

EPRI sponsor and/or organise many conferences and workshops across the world from specialised topics to user group forum e.g. “Energy Sustainability Interest Group Spring Workshop” and encourage international co-operation and collaboration e.g. “Japanese Boiling Water Reactor Vessel and Internals Program (BWRVIP) Research Integration Committee Meeting”. EPRI also provides training and advisory services e.g. “Balance-of-Plant Heat Exchanger Tubing Eddy Current Data Analysis Training and Workshop”.

Published reports from each of the technology projects are available to subscribing members but are often open to purchase to non members after a quarantine period.

For more details of EPRI and its activities please refer to https://www.epri.com/#/
Editor’s Titbits Section

Pune paved with plastic in Indian recycled road scheme

Roads in the Indian city of Pune are now being built with glue and tar made from recycled plastic waste. Following successful pilot tests, the Pune Municipal Corporation (PMC) plans to construct around 25 roads in different areas of the province using the technique. Waste such as plastic bags and polyurethane packing will be heated converting it into a powder, which is then added into hot tar.

The city generates around 1,700 tonnes of waste per day, nearly 12% of which is plastic. PMC says the recycled roads are stronger, more water resistant and more durable than standard tarmac infrastructure, with a lifespan extended by around two years resulting in reduced maintenance costs.

New living tyre rolls towards clean mobility

Goodyear has unveiled a new concept tyre designed to make urban transport cleaner, safer and more sustainable. The tyre manufacturer’s Oxygene concept, which it has unveiled at the 2018 Geneva International Motor Show, features living moss that absorbs carbon dioxide emissions from the air as it photosynthesises. The moss is kept alive by the tyre’s unique tread channelling water into it from the road surface, which also increases grip.

The Oxygene tyres feature a non-pneumatic construction that is 3D-printed with rubber powder from recycled tyres. The lightweight, shock-absorbing structure provides a long-lasting, puncture-free solution. It also, harvests the energy generated during photosynthesis to power its embedded electronics, including on-board sensors, an artificial intelligence processing unit, and a customizable light strip in the tyre’s sidewall that switches colours, warning both road users and pedestrians of upcoming manoeuvres, such as lane changes or braking.

Goodyear says if it was widely used in a city with around 2.5 million vehicles, such as Paris, the technology could generate around 3,000 tonnes of oxygen and absorb more than 4,000 tonnes of carbon dioxide each year.

Ed’s Note: The source of many of these titbits is Energy Live News.
Editor’s Titbits Section

Seaweed closes nuclear power station

Seaweed was the unlikely culprit of a nuclear power plant having to partially close down in Scotland for 2 weeks. The cooling system of EDF’s Torness plant in East Lothian became blocked with algae at the same time as freezing temperatures pushed up demand for electricity across the UK. After running on reduced output for a number of days, the power station returned to full power. In combination with the Hunterston plant on the west coast, Torness normally provides around a third of power needs across Scotland. An EDF spokesperson said: “We know that at certain times of year particular weather conditions in this part of the Forth estuary can lead to increased seaweed volumes which can enter the station’s cooling water intake system”.

UK must boost fracking to reduce reliance on Russian energy

The UK Government needs to speed up the development of fracking to improve the country’s energy security and make it less reliant on imports from Russia. That’s according to the Global Warming Policy Forum (GWPF), which says in light of the “crisis” in British-Russian relations, planning laws regarding the controversial energy source need to be changed as quickly as possible. It suggests this is necessary for the UK to avoid becoming too reliant on foreign imports for its gas supply in the near future. Recent winter shortages forced Britain to import emergency gas supplies from Russia, which the GWPF stresses is an “unsustainable situation”.

Upgrading old onshore wind farms

Upgrading onshore wind farms with new equipment as they reach the end of their scheduled operating lives could save consumers more than £77 million per year on energy bills. That’s the verdict from the Energy and Climate Intelligence Unit (ECIU), which says allowing successful sites to close would mean the UK could lose some of its most productive renewable energy facilities.

ECIU suggests that onshore wind farms due to close in the next five years should be upgraded with modern, highly efficient turbines; the UK’s generating capacity could be increased by more than 1.3GW. The ECIU claims this would yield more than 3TWh of electricity per year, enough to power around 800,000 homes. It makes sense to repower sites of the earliest wind farms, which tend to be in locations that have the best wind resource. “Existing infrastructure including network connections can also be reused or upgraded at costs lower than for new sites.”
**Editor's Titbits Section**

**MEES – Are you ready?**

The Minimum Energy Efficiency Standards (MEES) were introduced in England and Wales on 1 April 2018. This new legislation will make it unlawful for a landlord to let or renew a lease on a property if the energy performance certificate (EPC) rating is an F or G. This change also includes sublettings, which means that tenants that wish to dispose of unwanted space must also comply.

Although MEES only applies to properties rated an F or G, the methods used now to prepare EPCs have become more stringent and their quality has improved. Therefore, when an E-rated, compliant property is reassessed today, there is a risk of the rating dropping to an F or a G, especially if it was assessed shortly after EPCs were introduced in 2008–09. EPCs are a legal requirement under the Energy Performance of Buildings Regulations for any building constructed, sold or let after 2008 in the UK.

**Recycling Carbon Fibre Scrap Strengthens Permeable Pavement**

Carbon fibre composites are being increasingly used in wind turbines, automobiles and airplane component, leading to an increasing amount of waste material. Researchers from Washington State University (WSU) have devised a means of recycling this waste to improve the mechanical properties of pervious concrete. They made use of the original strength of the composites by keeping them in their cured composite form. Composite pieces are refined to the ideal sizes and shapes by mechanical milling.

Rainwater freely drains and seeps into the ground underneath such concrete, making it ideal for use in areas where urban flooding and storm water runoff control are concerns. The researchers are now conducting real-world tests on pavement applications and are working with industry to begin developing a supply chain. [sue.himmelstein@ieeeglobalspec.com](mailto:sue.himmelstein@ieeeglobalspec.com)

Interested in EMG Activities?

Contact: Prof Stuart Irvine, [s.j.c.irvine@swansea.ac.uk](mailto:s.j.c.irvine@swansea.ac.uk)

Items Relating to Newsletter Contact: Dr Peter Barnard, [peter.barnard@doosan.com](mailto:peter.barnard@doosan.com)
Upcoming Events

Next Committee Meetings
14 June 2018, IOM3, Euston Rd, London, UK (Note start is 13:00 followed by the Annual Lecture)

EMG Workshops/Conferences
Lithium from Exploration to End-user, 9 – 10 April 2018, London, UK
Power Plant Operation & Flexibility, 4 – 6 July 2018, London, UK

Other Workshops/Conferences/Courses of Interest
Structural Integrity and Materials in Nuclear Power Plant, 18 April 2018, Cambridge, UK
ASME Symposium on Elevated Temperature Applications of Materials for Fossil, Nuclear, and Petrochemical Industries, 3 – 5 April 2018, Seattle, USA
ALTA 2018 Nickel-Cobalt-Copper, Uranium-REE-Li and Gold-PM Conference & Exhibition, 19 – 26 May, 2018, Perth, Australia
EuroSuperalloys 2018, 9 – 13 Sept 2018, Oxford University, UK
OXY 2018, Dec, IOM3, Euston Rd, London, UK
High Temperature Materials Degradation Workshop 2019, 29 Jan 2019, Grantham, UK
Residual Stresses in Thermal Spray Coatings, 3 – 4 Sep 2018, Aberdeen, UK
Parsons 2019, 16 – 18 September 2019, Cranfield University, UK

For a list of events visit www.iom3.org/energy-materials-group/events