In 2017 the EMG has made important steps to become more member focussed while continuing to fulfil a strategic role. The introduction of the EMG Newsletter has been a tremendous success, thanks to the support of the EMG board and to Peter Barnard who has enthusiastically taken on the editor role, this is proving to be an effective vehicle for communicating to our members. The Newsletter runs hand in hand with the EMG micro-site http://www.iom3.org/energy-materials-group that is managed by Mike Gorley. If you haven't visited it recently, please look, there is lots of useful information to keep you up to date. You will see that the Materials Protecting the Environment (MPE) seminar will be held on the 21st February and follows on from the Materials Protecting Society launch event at 297ER on the 20th September. The range of talks from improved body armour through to buildings that can store heat over prolonged periods were stunning and the MPE seminar promises to be no less exciting and relevant to the role that materials play in facing societal challenges of today.


The IEA has traditionally taken a conservative view of the penetration of renewable energy, so it is notable that in this latest report they predict that solar power will become the cheapest source of electricity over the next 25 years. We are seeing a transition from the early adopter countries such as Germany and more recently the UK on the back of feed-in tariffs (FiTs) to developing economies of China and India. Ten years ago, the market was dominated by Europe, now it is dominated by the Far East. It is interesting to reflect that China, who a decade ago were satisfying their energy demand with building coal power stations, are now set to become world leader in wind, solar, nuclear and electric vehicles. Oil and gas will remain an important part of our energy mix with oil remaining the main source of energy for aviation and commercial vehicles and the dominant global supplier for oil and gas will be the USA. There is no doubt that we will be seeing a global revolution in energy supply over the next 25 years as the world strives to reduce CO₂ emissions and improve air quality.

I wish you all a very relaxing and enjoyable Christmas and hope you can recharge your batteries for an exciting New Year in energy materials.

Professor Stuart Irvine (Chair EMG)
**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


**Materials Today Energy**

Volume 6, Pages 1-163 (December 2017)

- Evolution of layered double hydroxides (LDH) as high performance water oxidation electrocatalysts: A review with insights on structure, activity and mechanism
- Membranes of carbon nanofibers with embedded MoO₃ nanoparticles showing superior cycling performance for all-solid-state flexible supercapacitors
- Construction of hierarchical porous carbon nanosheets from template-assisted assembly of coal-based graphene quantum dots for high performance supercapacitor electrodes
- Semimetallic core-shell TiO₂ nanotubes as a high conductivity scaffold and use in efficient 3D-RuO₂ supercapacitors
- Self-assembled three-dimensional graphene/polyaniline/polyoxometalate hybrid as cathode for improved rechargeable lithium ion batteries
- Fabrication of In₂O₃/ZnO hetero-epitaxial-junctions with enhanced PEC performances
- A rationally designed polysulfide-trapping interface on the polymeric separator for high-energy Li–S batteries
- Porous two-dimensional materials for energy applications: Innovations and challenges
- A high performance PEDOT/PEDOT symmetric supercapacitor by facile in-situ hydrothermal polymerization of PEDOT nanostructures on flexible carbon fibre cloth electrodes
- Enhanced photoelectrochemical response for hydrogen generation in self-assembled aligned ZnO/PbS core/shell nanorod arrays grown by chemical bath deposition
- Recent advances in noble metal-based nanocomposites for electrochemical reactions
- Self-driven hematite-based photoelectrochemical water splitting cells with three-dimensional nanobowl heterojunction and high-photovoltage perovskite solar cells
- Ag/Biochar composite for supercapacitor electrodes
- Synthesis of reduced cubic phase WO₃₋ₓ nanosheet by direct reduction of H₂WO₄·H₂O
Materials Today Energy

Volume 6, Pages 163-270 (December 2017)

- Chemical-state evolution of Ni in Mn single bondNi/polypyrrole nanocomposites under bifunctional air electrode conditions, investigated by quasi-in situ multi-scale soft X-ray absorption spectroscopy
- A novel Ni Coordination Supramolecular Network hybrid monolith of 3D graphene as electrode materials for supercapacitors
- Efficient electrocatalysis of hydrogen evolution by ultralow-Pt-loading bamboo-like nitrogen-doped carbon nanotubes
- Graphene-based electrochemical capacitors with integrated high-performance
- Microemulsion-controlled synthesis of CoSe₂/CoSeO₃ composite crystals for electrocatalysis in dye-sensitized solar cells
- Rapid electrochemical synthesis of δ-MnO₂ from γ-MnO₂ and unleashing its performance as an energy dense electrode
- Tailoring pseudocapacitive materials from a mechanistic perspective
- An extremely active and durable Mo₂C/graphene-like carbon based electrocatalyst for hydrogen evolution reaction
- Local growth of CuInSe₂ micro solar cells for concentrator application
- Nickel ferrite supported on calcium-stabilized zirconia for solar hydrogen production by two-step thermochemical water splitting
- Facile and scalable fabrication of highly loaded sulfur cathodes and lithium–sulfur pouch cells via air-controlled electrospray
- Polymide-polyether binders–diminishing the carbon content in lithium-sulfur batteries

Materials Today Energy is a multi-disciplinary, rapid-publication journal focused on all aspects of materials for energy, https://www.journals.elsevier.com/materials-today-energy
Committee Member Profile

Keith Harrison

(k.harrison428@btinternet.com)

Short CV

I am a Charted Scientist, a Fellow of IOM3 and have been a member of the EMG board since May 2010. In August 2016 I was elected as chair of the Industry and Technology policy Board (ITPB) which is the overarching Board for all the technical communities in IOM3. I’m a trustee of IOM3, a member of Council and a member of the Managing Board. I also sit on the Governance Review Working Group which is looking at all aspects of the Institute’s governance change programme. My speciality is Surface Engineering and between 2008 and 2016 I chaired the Surface Engineering Division.

Now semi-retired I have been involved with the surface engineering sector for over 50 years. I have worked in research and development, production and sales & marketing for a number of major companies such as British Gypsum, Rolls-Royce, Plessey Telecommunications and Sulzer. My involvement with Energy Materials goes back as long as Surface Engineering to 1967 when I joined Rolls-Royce as a Technologist. At Rolls-Royce I became involved with the development of thermally sprayed coatings for what was then the new generation of 3-shaft aero engines – the RB211, which has developed into the highly successful Trent family of engines.

Materials Interests

My interest in materials has always been associated with surface engineering and whilst at Rolls-Royce one of my roles was to pioneer the development of abradable coatings. These coatings make a significant contribution to increasing the efficiency of the engine by allowing rotating parts, such as blades and seal fins, to machine their own seal paths. I continued with the development of abradable coatings at Sulzer Metco in conjunction with Rolls-Royce and the major industrial gas turbine manufacturers. This technology is now standard in both aero and industrial gas turbines and continues to be developed as compressor and turbine operating temperatures increase.

Over the years I have been involved in the development of thermally spayed coatings in a number of energy related applications for example, the development of coating systems to combat fireside corrosion and wear problems in coal-fired utility boilers with the CEGB Engineering Laboratories and Scientific Service Departments (1985 – 1991)

More recently I’ve co-authored two energy materials related white papers for the Innovate UK Knowledge Transfer Network (was Materials KTN, now part of KTN Ltd): “Surface Engineering applied to Fossil-fuel Power Generation” (June 2010) and “Surface and Particulate Engineering Opportunities in the Nuclear Power Sector” (June 2012)

Outside Interests

Now that I’m too old to play squash and other sports in my spare time I enjoy walking, gardening and being with my grandchildren. I’m also actively involved in my local community as a Parish Councillor and as co-organiser of the annual village open gardens day. I am a committee member of the East Midlands Materials Society and help with the organisation of their technical programme and national conferences.
EMIRI

In 2012, following the development of the Strategy Energy Technologies (SET) plan and its associated SET Plan Materials Roadmap, key industrial actors and leading research organizations felt the need to associate under the Energy Materials Industrial Research Initiative (EMIRI) ... an industry-oriented grouping complementary to established actors, uniquely positioned to span the innovation cycle and focusing solely on advanced materials for low carbon energy & energy efficiency technologies.

EMIRI is driving forward research and innovation in advanced materials for low-carbon energy applications. By bringing together research, industry and trade organisations, and leveraging Europe’s world-class capability in advanced materials, EMIRI aims to contribute to generating tangible growth in economic value and employment opportunities for Europe.

- EMIRI acts as an Industrial Body of developers, producers & key users of Advanced Materials for low carbon energy by shaping an industry-friendly innovation-oriented EU policy framework based on SET Plan
- EMIRI is a catalyst in ensuring that public private interactions are reinforced and public innovation programs do contribute to protecting & reinforcing the industrial sector of Advanced Materials for low carbon energy

EMIRI is an association with a membership of 22 industrial companies, 31 academic/research organisations and 12 associations of which IOM3 is one. In its simplest form EMIRI is a lobby group representing the voices of its member organisations within the halls of the European Union. Their stated goal is “Reinforced public private interactions between key industrial players, leading research organizations and European Commission are key to launching & operating effective & efficient innovation programs supporting the SET Plan Integrated Roadmap”

Since its creation EMIRI has provided research and innovation input for Horizon 2020’s 2014 /2015 work programmes, contributed strongly to the SET Plan Integrated Roadmap Working Group and has participated in the various SET Plan Energy Industrial Initiatives (EIIs) of the European Commission. EMIRI has also provided input to the structure of the transnational M-ERA NET programme (Low Carbon Energy Materials) and has established constructive communication channels with the various Directorate Generals of the European Commission, as well as other associations such as the Brussels-based European Technology Platforms (EUMAT, TP Wind, ETP PV) and others (EERA, EASE, ...).

To apply for membership or more information on the work of EMIRI please refer to http://emiri.eu/about
Editor’s Titbits Section

Vattenfall Announces Major Wind Power Supply Deal with Microsoft

Vattenfall has signed a ten-year agreement to power Microsoft’s international data centre operations in the Netherlands with wind power from a new onshore wind farm that will be constructed at Wieringermeer polder, near Microsoft’s data centre in the Netherlands.

The Wieringermeer Wind Farm will eventually include 100 wind turbines, with the first turbines coming on stream from 2019. Together, they will produce approximately 1.3 billion kWh (1.3 TWh) of renewable electricity, comparable to the consumption of around 370,000 households.

(Ed’s Note: I’d be if amazed 1 data centre consumes the same power as 370,000 homes. I only hope that some of the power goes to domestic use, but then my laptop kicks out lots of heat)

Gas-Fired Power Plants Targeted for Closure in California

NRG Energy Inc. plans to retire three gas-fired power plants in California by the end of 2017.

“Given the market conditions, it’s not financially feasible to operate these units,” a spokesman said.

NRG had planned to build a gas-fired facility to replace two of three existing power plants by 2020. The third power plant was expected to remain in operation. Recent reports have suggested that California has an oversupply of natural gas-fired generating units. At the same time, energy storage technology is being seen in some instances as an alternative to gas-fired power plants.

In California, the debate is not coal versus gas but gas versus distributed generation and storage.

To contact the author of this article, email david.wagman@ieeeglobalspec.com

$25.38/MWh bid sets new record low for 24/7 block mixing wind and solar

Verano Capital, an American project developer headquartered in Santiago, announced today that the 47 MW solar project they initially developed was selected in ChileaEUR(tm)s latest energy tender with a winning bid at $25.38/MWh, the lowest 24/7 block price combining solar and wind ever recorded in the history of energy tenders.

The winning bid was offered by a solar project which will be coupled with wind projects to offer a 24/7 supply over a 20-year period. Contracts were awarded at an average price of $32.50/MWh, which represents a 75% drop from the peak of $130/MWh reached in the 2013 tenders. These are the lowest renewable energy prices we have ever seen on a 24/7 energy auction anywhere in the world.
Editor’s Titbits Section

Crops Thrive in Magenta Solar Greenhouse

An electricity-generating solar greenhouse designed by University of California-Santa Cruz researchers conserves water and produces fruits and vegetables of the same quality as those cultivated in conventional greenhouses. The structure incorporates Wavelength-Selective Photovoltaic Systems (WSPVs) technology that generates electricity more efficiently and at less cost than traditional photovoltaic systems.

Transparent roof panels are embedded with a bright magenta luminescent dye that absorbs light and transfers energy to narrow photovoltaic strips that generate electricity. WSPVs absorb some of the blue and green wavelengths of light but let the rest through, allowing the plants to grow. "We have demonstrated that 'smart greenhouses' can capture solar energy for electricity without reducing plant growth, which is pretty exciting," said Michael Loik, professor of environmental studies.

The researchers assessed photosynthesis and fruit production across 20 varieties of tomatoes, cucumbers, lemons, limes, peppers, strawberries and basil grown in magenta glasshouses at two locations on campus and one in Watsonville, Calif. None of the plants were adversely affected by the solar energy system, and 20 percent actually grew better under the magenta solar panels. Water savings were an added benefit: plants needed 5 percent less water relative to those grown in conventional glasshouses.

Greenhouses use electricity to control temperature and power fans, lights and other monitoring systems. "This technology has the potential to take greenhouses offline," said Loik. Cost per panel of WSPV technology is 65 cents per watt — about 40 percent less than the per-watt cost of traditional silicon-based photovoltaic cells.

To contact the author of this article, email sue.himmelstein@ieeeglobalspec.com

London lamp posts to power electric vehicles

A new project which allows residents to charge their electric vehicles (EVs) by plugging into lamp posts has been launched. Kensington and Chelsea Council plan to install 50 SimpleSockets, which are charging points that fit directly into existing lamp posts.

The charging points will be located next to pay and display parking bays and will have a tariff of £0.165 per kWh of electricity. To access the network, users will have to buy a cable with an inbuilt electricity meter from Ubitricity, with two options of £199 and £299.

Cllr Gerard Hargreaves, Kensington and Chelsea Council Lead Member for Transport said “Retrofitting street lamps with charging technology allows drivers to conveniently charge their vehicles closer to home, while helping to tackle air pollution in London. Lamp post charging is also more cost-effective and much less obtrusive as the charging points require no additional street furniture.”
Upcoming Events

Next Committee Meetings
Wednesday 31 Jan 2018, at IOM3, 297 Euston Rd, London

EMG Workshops/Conferences
None announced, but several in the planning

Other Workshops/Conferences of Interest
- Energy from Waste Conference, 6 – 7 Dec 2017, London, UK
- 14th International Conference on Functional Energy Materials, 6 – 7 Dec 2017 Dallas, USA
- 3rd IEA CCC Workshop on A-USC Power Plants, 13 - 14 Dec 2017, CSM, Rome, IT
- Energy Storage 2018 Conference, 31 Jan – 1 Feb 2018, Cologne, Germany
- ASME Symposium on Elevated Temperature Applications of Materials for Fossil, Nuclear, and Petrochemical Industries, 3 – 5 April 2018, Seattle, USA
- EPRI Expert Workshop on Creep Continuum Damage Models for Structural Mechanics in Collaboration with ASME PVP, 19-20 July 2018, Prague, CZ
- EuroSuperalloys 2018, 9 – 13 Sept 2018, Oxford University, UK
- Parsons 2019, 16 – 18 September 2019, Cranfield University, UK

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

Interested in EMG Activities?
Contact: Prof Stuart Irvine, sj.c.irvine@swansea.ac.uk

Items Relating to Newsletter Contact: Dr Peter Barnard, peter.barnard@doosan.com