Queen Mary
University of London

School of Engineering and Materials Science

7rd Industrial Advisory Board 7th March 2018

Prof James Busfield

Director of Industrial Engagement

Head of the Division of Materials Engineering

IAB terms of Reference

http://www.sems.qmul.ac.uk/ilf/iab/

Terms of reference (Agreed at the IAB on 4th March 2015):

- To provide a regular channel of communication between the School and relevant sections of industry.
- To ensure that that School receives appropriate and expert advice on the relevance of its teaching and research.
- To ensure that we maintain accreditation status with all our relevent professional bodies.
- To advise on other School activities as the Board sees fit.

Benefits to the School include:

- The quality of the School's degree programmes is maintained.
- The School is advised on which research activities might be undertaken to meet current industrial needs.
- The employability of the School's students is enhanced.
- The board can advise the School on ad hoc matters identified by either by the academic staff or by the panel members.

Benefits to board members include:

- A raised awareness of the industrial partner's activities amongst staff and the students in the School.
- To ensure that SEMS graduates have the essential skills that are required by them as future employers.
- To provide a suitable academic partner to help secure EPSRC / Innovate UK funding for research projects.
- Networking opportunities with other companies in the SEMS network.
- Access to a large student population to undertake a wide range of projects.
- Access to the extensive equipment and facilities that are available in the School.

The main methods of interacting with the School are:

- Recruitment opportunities for either work experience or for graduate positions - Staff (often SEMS alumni) from the company are invited to participate in the various ILF activities.
- College/Industrial Studentships - Ensure that panel members are made aware of the college studentships programme, where projects are funded jointly by a college scholarship with an industrial top up.
- Guest lectures are delivered IAB members.
- Industrial Visit Programme supported by visits to the IAB companies. The School undertakes about 30 industrial site visits each year.
- Prize Day - Companies will support whenever possible student prizes, that are awarded at the annual prize day. This event will coincide with the annual research focused ILF in the School.

Addition Item for Terms of Reference (Agreed at the IAB on 29 Oct 2015):

- The outcomes from each IAB meeting will generate a series of proposed actions for individual streams.
- These will be considered by the Education and Learning Committee which will then create and implement a school wide action plan.
- The outcomes of this action plan will be reported back at the next available IAB.

In summary:

- To develop graduates trained as required by industry
- To facilitate collaboration
- To work on real problems of scientific benefit to society

Agenda for IAB meeting March 2018

- School updates / New staff / Space Refurb / New programmes
- Outline of existing mechanisms
- MEng / MSc Student Project Collaboration
- Year in Industry Options

Potential Industrial Collaboration Mechanisms:

- CDT - Polymer Engineering (with Warwick)
- CDT - Bioengineering (SEMS lead)
- London Institute of Transport Technology (LITT) bid
- Degree Apprenticeship
- Knowledge Transfer Partnerships

IAB Membership Today

Dr Ravi Prabaharan - Advanced Healthcare Ltd
Dr Carolyn Small - ALCOA Manufacturing Ltd.
Mr David Singerton - Anglian Water
Dr Nigel Smith - Biomedical Consultancy LTD
Dr Shiva Pingle - BP plc
Dr Monisha Phillips - BSI Healthcare
Dr Amy Kinbrum - De Puy
Dr Joe Hallett - Fenner Precision
Dr Zulshan Mahmood - Ford
Dr Tony Harrison - Haydale Composite Solutions
Dr Roly Whear - Jaguar Land Rover
Mr Ashley Gillibrand - Jaguar Land Rover
Mrs Christine Hobday - L3 Commercial Training Solutions

Dr Philip Jackson - Lucideon Ltd
Mr Tony Kinsella - Lucideon Ltd
Dr Kirk Atkinson - MOD
Dr Chris Stevens - NGF Europe
Dr Graham Deacon - Ocado Technology
Mr Thomas Poon - Rolls-Royce Submarines
Dr Louise Bailey - Schlumberger
Dr Joachim Sihler – Schlumberger
Mr Rich Walker - Shadow Robot Company
Mr Tom Dowden - Sugru
Mr John Thomson - Vygon
Mr Richard Smith - Winchester Consulting

Extended IAB Membership

- Airbus
- Altair Engineering
- AR consulting
- ARTIS
- Aviation Skills Partnership
- BAe Systems
- Becker Group
- Biocompatibles UK
- Cameron
- Croda Europe
- Electrosciences
- Ford
- GSK
- Infineum
- Innovate UK
- KTN
- LRQA
- Manufacturing Technology Centre
- Qinetiq
- Quanta Fluid Solutions
- RJM International
- Rolls Royce
- Unilever
- Weir Advanced Research
- Xeno Medical

Queen Mary University of London (QMUL)

- Founded in 1785 at the Royal London Hospital
- The People's Palace at Mile End was set up in 1887
- Russell Group university
- 4,000 members of staff and more than 25,000 students
- Annual income of £430m (£140m is research funding)

QMUL Student Profile

- 162 nationalities
- 91% are from state school
- 60% are BAME
- 42% are first entry into Higher Education
- 27% are from households where the annual taxable income is less than £10k

School of Engineering and Materials Science (SEMS)

- Formed by the merger of Engineering and Materials Departments in 2007
- 2014 SEMS REF results were exceptional.
  - General Engineering submission was ranked 7th out of 62 in UK and 4th on the basis of our research outputs
- ~60 academic staff (16 new staff recruited in the last year)
- ~1400 students (76% UG, 5% PGT, 19% PhD)
- ~60 Post Doctoral Research Assistants

Updated Division Structure in SEMS

Aerospace Engineering and Fluid Mechanics	Bioengineering	Chemical Engineering and Renewable Energy	Materials Engineering	Mechanical Engineering, Robotics and Design

Division Leadership





Industrial Engagement Leads



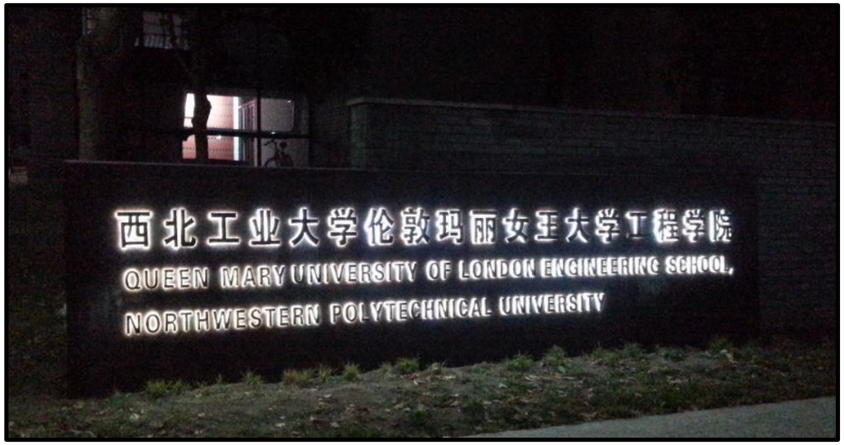


Recent Programme Developments

- Relaunch of “Biomaterials for Biomedical Sciences” BSc / MSci (2016)
- Robotics Engineering BEng / MEng (2016)
- MSc in Biomedical Engineering with Tissue Engineering & Biomaterials (2016)
- MSc in Biomedical Engineering with Imaging & Instrumentation (2016)

- Chemical Engineering MEng / BEng (2017)
- Materials BEng joint programmes with NWPU in China (2017)

QMUL Engineering School, NPU



- 249 students on two materials degree programmes
- First semester teaching and exams completed successfully
- High student progression rate
- 5 Joint Research Centres

QMUL Engineering School, NPU

- Adopting QMUL model for PBL based delivery
- High level of student engagement

16 Recent Staff Appointments

Prof Colin Bailey - Principal
Dr Aleksandra Birn-Jeffery - Lecturer in Bioengineering
Dr Edo Boek - Reader in Chemical Engineering
Dr Joe Briscoe - Lecturer in Functional Materials
Dr Andrew Buchan - Lecturer in Engineering Science
Dr Rafael Castrejón-Pita - Lecturer in Applied Sciences
Dr Gabriel Cavalli - Senior Lecturer in Materials Science
Dr Jun Chen - Lecturer in Engineering Science
Prof Sir Colin Humphreys - Professor of Materials Science
Dr Thomas Iskratsch - Lecturer in Bioengineering
Prof Xi Jiang - Professor of Mechanical Engineering
Prof Rob Krams - Professor in Molecular Bioengineering
Dr Stoyan Smoukov - Senior Lecturer in Chemical Engineering
Dr Petra Szilagyi - Lecturer in Functional Materials
Dr Roberto Volpe - Lecturer in Chemical Engineering
Dr Han Zhang - Lecturer in Chemical and Materials Engineering

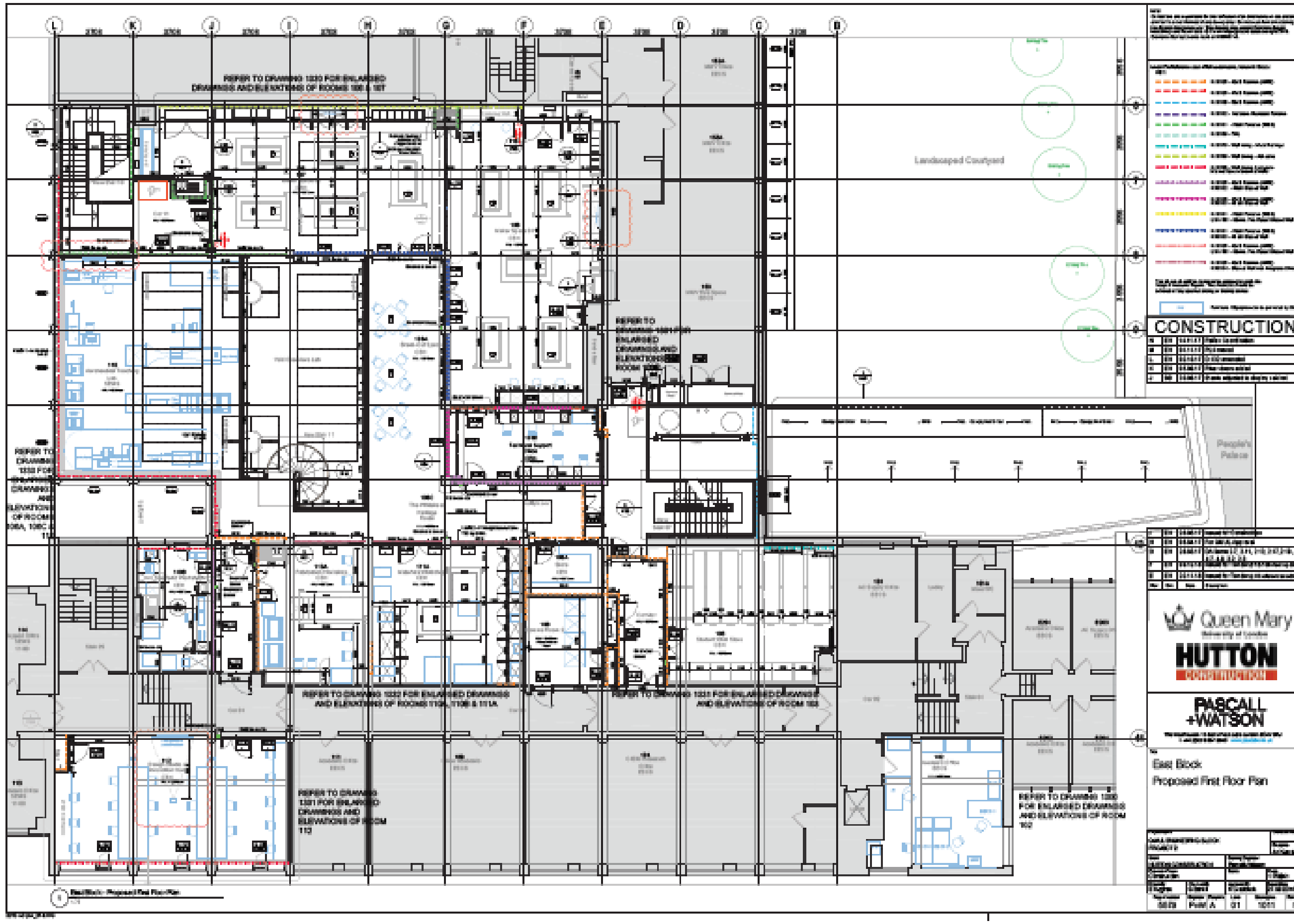
New Facilities 2016-17

£7M spent on refurbishing (mostly West Side)

- Ground Floor Dedicated Teaching Hub
- Robotics Lab
- 1st floor research labs

New Facilities 2017-18

£12M spent
- Aerospace
- Design Studio
- Creative Hub



SEMS / Industry Price List

Fully Funded Post-Doctoral Research Assistant	£123,197 - £128,206pa
Fully Funded PhD studentship (any student)	£148,000 for 3.5 years
Fully Funded PhD studentship (EU national)	£115,000 for 3.5 years
Embedded Researcher in SEMS	£30,000 + facilities
Year in Industry Studentship	min £15,500 per annum
Work Experience Studentship	min £1,100 per month
MEng Group Project Sponsorship	£1,500 each group
MSc student project Sponsorship	£500 per project
BEng student project Sponsorship	Consumables
Student Prizes	£500 min recommended
Contract Research	Individually costed

SEMS / Industry Price List

PhD Case Award from EPSRC with Industrial Support (UK National)

~£84,900 from EPSRC and £28,300 from a Company for a full studentship

Half funded PhD studentship with Industrial Support (China Scholarship, Principal's Scholarship …)

~£62,000 for a 36 month or £82,000 for a 48 month studentship

Industrial support for RCUK (EPSRC, BBSRC, NERC, STFC or MRC), Innovate UK or a QM Proof of Concept bid

Individually costed depending upon the research collaboration

Forthcoming Calendar of Interactions

27th Apr 2018	Proposal deadline for collaborative (BEng / MEng / MSc) projects (Sept 2018 start)
1st Jun 2018	Confirm sponsorship of student prizes awarded in November
3rd Jul 2018	Last possible date to advertise work experience opportunities (summer 2018 start)
5th - 9th Nov 2018	Semester 1 Field Trips
14th Nov 2018	Research Focus ILF / Autumn IAB

Year in Industry 2017 Starts

Altair Engineering	HiETA	Smith Medical
Aparito	Lucideon	Toyota
Arconic x 2	Network Rail x 2	Trelleborg
Cummins	QMP Quality Metal	UKAEA
Delphi	RDG x 2	UTC Aerospace
Dornan Engineering	Rolls Royce x 6	Vauxhall
GE x 2	Schroders	Vertex
GKN Aerospace	Siemens Traffic Solutions	Zimmer Biomet
GSK	Siemens	Zotefoams

EPSRC funding for Doctoral Training

Doctoral Training Partnerships	• Block grants to universities for flexible PhD support, based on research income
Industrial CASE	• Highly user focused, company chooses project and university
Centres for Doctoral Training	• Cohort-based in areas of national need

Centres for Doctoral Training (CDT)

- Each CDT will last for 9 years
- 5 entry cohorts of at least 10 students
- 20-40% of funding from non RCUK
- Compulsory element of training
- Limitations on the number of applications
- Outline deadlines 13th March 2018
- Full proposal deadline 10th July 2018
- If awarded first intake Sept 2019

CDT in Predictive Bioengineering for Healthcare Innovation

- Bid for 60 students (40 funded by EPSRC) over 5 intake cohorts
- Aim to develop a bioengineering-based toolkits for accurate, predictive testing of healthcare innovations for safety, reliability and efficacy.

  1) organ-on-a-chip devices for testing pharmaceuticals

  2) experimental in vitro models for predicting the behaviour of biomaterials and medical devices

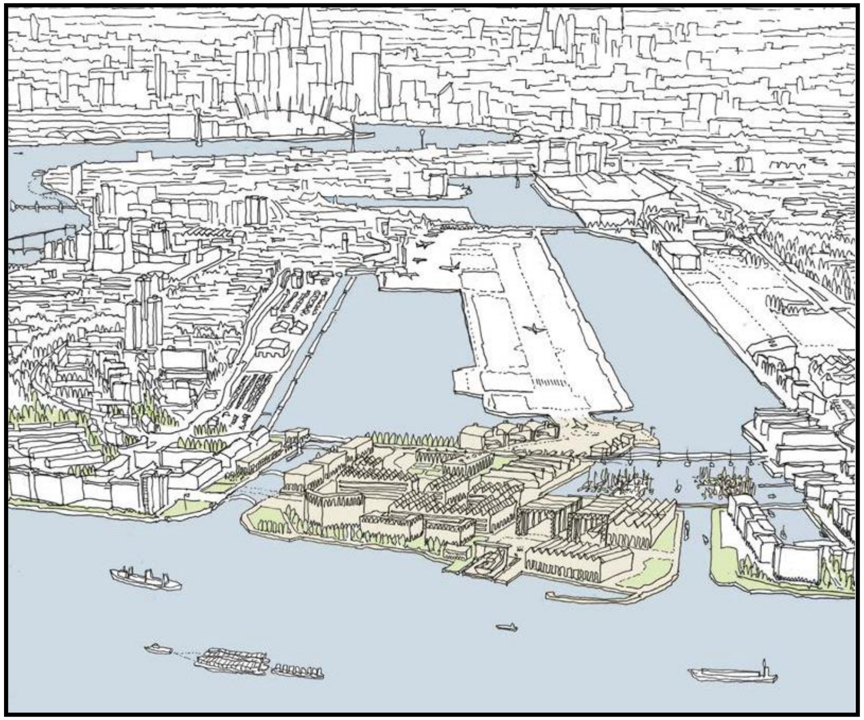
CDT in Predictive Bioengineering for Healthcare Innovation

- Building upon QMUL’s reputation in this area.
- Extensive in-house bioengineering-based understanding of biomaterials, biocompatibility, biomechanics, mechanobiology, sensor technology, microfluidics and computational modelling
- All of which is coupled with a multidisciplinary knowledge of the biological, industrial and the regulatory environment.

CDT in Polymer Engineering

- Bid for 50 students (28 funded by EPSRC) over 5 intake cohorts.
- Joint application with Warwick University
- Building upon QMUL and WMG’s reputation in this area
- This CDT will span polymer science, engineering and manufacturing by combining chemistry, physics, characterisation, processing and modelling of polymeric materials

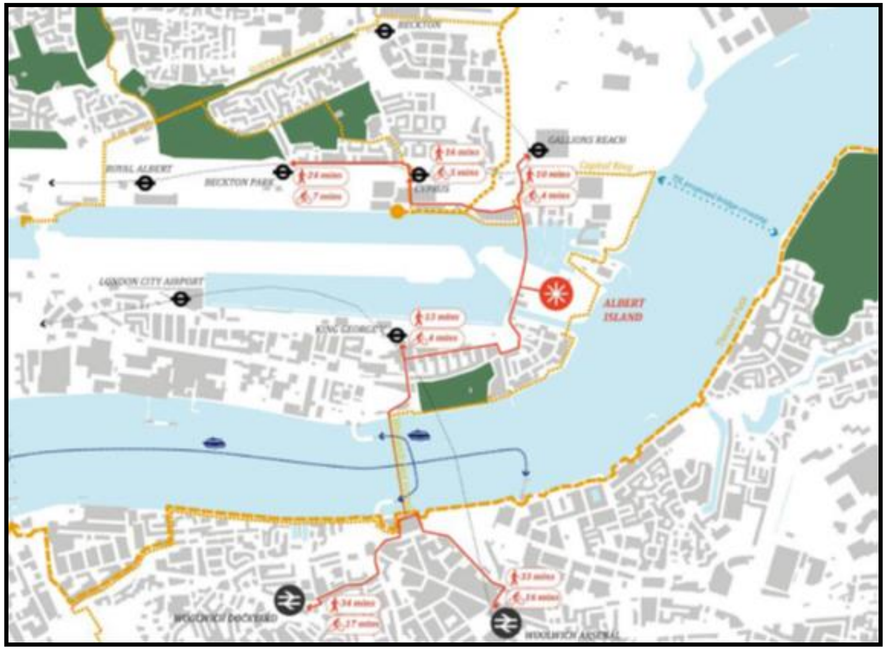
Albert Island Partnership



- GLA has confirmed London & Regional Properties as the development partner for Albert Island in the Royal Docks.
- The development will create a transport technology hub, serving a unique cluster of businesses to serve the "4R": road, river, runway and rail.

Albert Island Partnership

- Over 5,900 net jobs will develop on site, with over 6,900 net additional local jobs.
- Over 80% of all the jobs will be at advanced and higher skill levels.
- QMUL is the HE Educational Partner to the Redevelopment Project



Institutes of Technology

- The Department for Education launched a competition to establish new Institutes of Technology (IoTs) in 2017
- Stage One proposals were due last week
- Total funding from a £170m capital fund
- QMUL led an £18M bid for the London Institute of Transport Technology (LITT)
- If successful the first intake is in 2020

London Institute for Transport Technology (LITT)

QMUL is the lead HE partner with 3 FE partners:

- Newham College (Rail & Road)
- Brockenhurst College (River)
- Norwich City College (Runway)

Current plans are for:

- ~1850 learners at steady state
- 20% at level 3 apprenticeship
- 51% at levels 4 & 5 apprenticeship
- 29% at degree apprenticeship (level 6 or 7)

LITT Industrial Partners

Our IOTs anchor partners:

- Siemens
- Port of London Authority
- London & Regional Properties

Other partners include:

- Serco
- City Cruises
- AECOM
- Network Rail
- CVU
- WYG
- Livetts & Bennett’s Barges

Degree Apprenticeships

- All employers with a wage bill over £3M now pays an apprenticeship levy of 0.5% of your salary costs.
- This money is allocated to your own apprenticeship service account.
- Two types of apprenticeship already exist
  - apprenticeship standards - each standard covers a specific occupation and sets out the core skills, knowledge and behaviours an apprentice will need; they are developed by employer groups known as ‘trailblazers’
  - apprenticeship frameworks - a series of work-related vocational and professional qualifications, with workplace- and classroom-based training
- You can invest in the training of your staff to degree (level 6) or higher degree (level 7) apprenticeship.

Knowledge Transfer Partnerships

- Knowledge Transfer Partnerships aim to help businesses improve their competitiveness and productivity through the better use of knowledge, technology and skills that reside within the UK Knowledge Base
- They are funded by:

Innovate UK

Knowledge Transfer Partnerships

How does it work

- A business identifies a strategic need for a new product or process
- An academic with experience in the relevant field supervises the project for its duration (1-3 years)
- A graduate is employed to work on the project under the supervision of the academic and company

Typical Funding Model

[grey = fixed] [blue = variable]

	p/a
Associate Employment Costs	£ 27,000 – 45,000
Associate Development	£ 2,000
Travel & Subsistence	£ 2,250
Equipment & Consumables	£ 1,500
Academic supervisor (average estimate)	£ 12,500
Associate Estates costs	£ 1,600
Associate indirect support costs	£ 13,650
Total Partnership Budget p/a	£ 68,500

Government Contribution 67% or 50% (EPSRC/Innovate UK)

Company Contribution:

SME 33% of total budget	£ 22,605
Large Company 50% of total budget	£ 34,250

Benefits

Business Benefits:

- Access qualified people to spearhead new projects
- Access experts who can help take your business forward
- Develop innovative solutions to help your business grow
- Improve your performance/business operations

Studies show:

- An increase of over £240,000 in annual profits before tax
- The creation of two genuine new jobs
- An increase in skills of existing staff

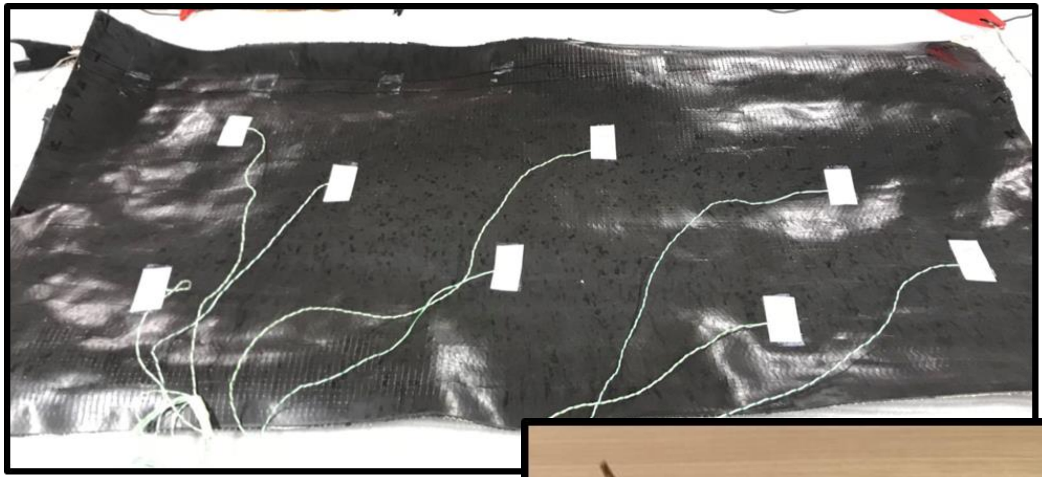
LMK Thermosafe KTP case study

Initial Project Aim

- To develop conductive polymer composites that exhibit self-regulating heating properties
- For use in specialist industrial heating applications
- Industrial applications in potentially explosive environments governed by the strict safety standards

LMK Thermosafe KTP

A three year KTP developed



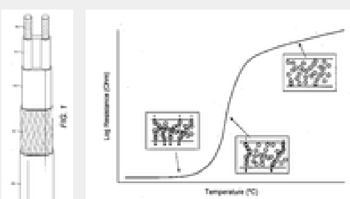
LMK Thermosafe KTP

Conductive polymer composite

Abstract

A conductive polymer composite co
polymer matrix comprising a first po
second polymer are immiscible; and
of the first polymer and the second
composite of any preceding claim c
second polymer, wherein the first po
conductive particles in the first poly
second polymer. A heating element
polymer composite disposed thereb
comprising this heating element.

Images (6)



Classifications

Heating element

Abstract

A self-regulating heating element comprising a heating core disposed between a pair of electrodes, the heating core comprising: a first conductive polymer composite comprising first conductive particles dispersed in a first polymer matrix, the first conductive particles having an aspect ratio greater than 100; and a second conductive polymer composite comprising second conductive particles dispersed in a second polymer matrix, the second conductive particles having an aspect ratio of from 1 to 100 and a longest dimension of greater than 10 μm, wherein the first conductive polymer composite and the second conductive polymer composite are arranged in series between the pair of electrodes.

Classifications

H05B3/146 Conductive polymers, e.g. polyethylene, thermoplastics

View 1 more classifications

WO2018002633A1
WO Application

Find Prior Art

Other languages: French

Inventor: Emiliano BILOTTI, H
Newton, Jamie EVANS

Original Assignee: Lmk Ther

Priority date: 2016-06-30

Family: GB (1) WO (1)

Date	App/Pub
2017-06-29	PCT/GB2
2018-01-04	WO201

Info: Patent citations (4), Sim
Related Applications

External links: Espacenet, Gl

Queen M
University of Londo

LMK Thermosafe KTP

FULL PAPER

Flexible Devices

Universal Cont
Self-Regulating

Yi Liu, Han Zhang, H*
James J. C. Busfield, T

Smart heating devices with reli efficiency, combined with addit are of particular interest in hea Unfortunately, the developmen mally conflicting requirements efficient Joule heating performa design strategy based on a seri composites (CPC) is shown to properties. Hooke's and Kirchh predict the overall pyroresistive or parallel configurations, henc and mechanically flexible Joule The heater is characterized by below the self-regulating temp sharp positive temperature coe of around 10⁶. Flexibility and to meric thermoplastic polyureth The universality of the approac matrices and conductive fillers obtained.

1. Introduction

Conductive polymer composite smart materials that have attra both academia and industry f

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Materials Chemistry

PAPER

Check for updates

Cite this: DOI: 10.1039/c7tc05621d

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Yi Liu, [ab] Ha
Mark Newton,

Flexible and cont as healthcare dev heating devices conductive filler binary polymer pyroresistive prop did not only impro For the first time, localization of con performance of morphologies was blend compositior included immiscit morphology. In do polymer blend bas

Received 7th December 2017,
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DOI: 10.1039/c7tc05621d

rsc.li/materials-c

Introduction

Conductive polymer composites (CPCs) have attrac amounts of attention due to their ease of fabrica range of applications.[1–3] Many novel devices in the monitoring and wearable electronics are made various functionalities including sensitivity to st humidity, and temperature.[4–9] Self-regulating h benefit from another intrinsic feature found in CP temperature coefficient (PTC) effect, where the elec increases with increasing operating temperatu increment in resistance of these materials is in co

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ELSEVIER

journal ho

Effect of particle size and shape of conductive polymer compos

Eric Asare [a], Jamie Evans [b], Mark Newto

[a] *Queen Mary University of London, School of Engineering and Mater*
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[c] *Nanoforce Technology Ltd., Joseph Priestley Building, Queen Mary U*

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Conductive polymer composite
Model system

ABS

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1. Introduction

With the increase of functionality and 'smartness sumer products, there is an urgent need for technol fields like wearable electronics, flexible displays and quire new materials and devices able to respond, pos ly, to a number of stimuli. Conductive polymer promise to address some of the above challenges, as demonstrated capability in sensing strain [1], liquid damage [4–6] and even degradation [7]. CPCs can als pyroresistive behaviour with large positive tempe (PTC) effects, as demonstrated since the 1970s [8], applications in self-regulative heaters and over-c [9–11].

Different theories have been proposed for the or fect, all somehow addressing the mismatch of the t coefficients of polymer matrix and filler but from diffe in terms of percolation behaviour [12], void formati polarisation [14], tunnelling current [15,16], or poten height [17]. Nevertheless, none of the above concep explain the PTC effect, indicating there is still a lack after more than four decades. We believe this is p

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Nanocomposites Origin

Effect of mixed fillers on positive temp coefficient of conductive polymer com

Eric Asare[1], Al Basir[1], Wei Tu[2], Harshit Porwal[1,3], Han Zhang[1], Yi Liu[1], Ja Mark Newton[3], Ton Peijs[1,2] and Emiliano Bilotti*[1,2]

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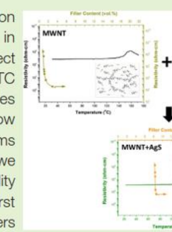
[3]LMK Thermosafe Ltd., 9-10 Moonhall Business Park, Helions Bumpstead Rd, Haverhill, Suffolk

Abstract This paper investigates the trade-off between low percolation threshold and large positive temperature coefficient (PTC) intensity in conductive polymer composites (CPCs). Conductive particles with low aspect ratios and large dimensions have been demonstrated to induce large PTC intensity in CPCs. Conversely high aspect ratio conductive (nano)particles like carbon nanotubes (CNTs) are desirable because of their extremely low percolation threshold (typically well below 1 wt.%), providing benefits in terms of reduced density, brittleness, costs and improved processability. Herein we report on combinations of different conductive fillers to explore the possibility to obtain both low percolation threshold and high PTC intensity. For the first time we use model systems in which at least one of the two conductive fillers is of relatively homogenous size and shape to facilitate unraveling some of the complicated inter-relationships between (mixed) conductive fillers and the PTC effect.



Keywords Pyroresistivity, PTC effect, Resistance-temperature behavior, Conductive polymer composite,

Cite this article Eric Asare, Al Basir, Wei Tu, Harshit Porwal, Han Zhang, Yi Liu, Jamie Evans, Mark Nev Emiliano Bilotti: *Nanocomposites*, doi: 10.1080/20550324.2016.1192796

Introduction

Conductive polymer composites (CPCs) are promising materials for a series of challenging new applications like wearable electronics, smart textile and soft robotics, owing to their demonstrated capability to sense and response to a number of stimuli such as strain,[1] liquid and gasses,[2,3] damage[4–6] and degradation.[7]

One of the first phenomena observed in CPCs, which have found commercial exploitation since the 1980s,[8] was the pyroresistive effect, commonly referred to as positive temperature coefficient (PTC) effect. PTC is defined as the increase in electrical resistivity over a relatively narrow temperature range,[9–14] usually in correspondence of a phase transition of the host polymer matrix (melting temperature or glass transition temperature). As the temperature increases and exceeds a certain range, the continuous network formed by the conductive filler is disrupted causing the composite

applications like self-regulated hea protectors.[15–18]

A pyroresistive material would id characteristics including: a very large as the log of the ratio of the maximum temperature resistivity), defined trans perature range combined with a cor and after transition (hence no negat cient (NTC) effect), tuneable switchin over a large number of heating/cooling to other external stimuli (e.g. environm etc.), combined with additional applica istics like flexibility, etc.

A lot of approaches have been exp of the above including polymer bl phases and networks,[24–30] fillers of shape, aggregates, mixed fillers,[10,31–33]

Breakout - Specific Themes

- CDT - Polymer Engineering (with WMG)
- CDT - Bioengineering (SEMS lead)
- London Institute of Transport Technology
- Degree Apprenticeships
- Knowledge Transfer Partnerships

Next Meeting

14th November 2018