

Dr Stephen Kukureka

Senior Lecturer
Deputy Head of School

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About

Stephen Kukureka has research interests in the mechanical properties and applied physics of polymers. This includes mechanical reliability of plastic electronics such as flexible displays and touch screens, thin-film transistors and flexible solar panels. He also has interests and substantial experience in polymer tribology for machine elements (gears, cams and pulleys). Other interests include mechanical reliability of optical fibres and sensors as well as polymers for biomedical engineering.

Stephen teaches a range of courses in polymer engineering, manufacturing and materials selection to several taught programmes at BSc, BEng, BMedSci, MEng, MSc, MRes and EngD levels. He is Deputy Head of the School of Metallurgy and Materials as well as Senior Tutor and is Course Tutor for the undergraduate programmes in Mechanical and Materials Engineering. Stephen also coordinates direct-entry undergraduate recruitment from China for both the School of Metallurgy and Materials and the School of Mechanical Engineering

Qualifications

- PhD in Materials Science, University of Cambridge, 1982
- MPhil in Materials Technology, University of Cambridge, 1979
- BSc in Physics, University of Bristol, 1978
- Chartered Engineer (CEng)
- Fellow of the Institution of Mechanical Engineers (FIMechE)
- Fellow of the Institute of Physics (FInstP)
- Fellow of the Institute of Materials, Minerals and Mining (FIMMM)
- Fellow of the Higher Education Academy (FHEA)

Biography

Employment history

- 2012 – Deputy Head, School of Metallurgy and Materials, University of Birmingham
- 2001 – (present) Senior Lecturer in Metallurgy and Materials, University of Birmingham
- 1990 – 2001 Lecturer in Metallurgy and Materials, University of Birmingham
- 1987 - 1989 Senior Lecturer in Polymer Engineering, Polytechnic of North London
- 1983 - 1987 Research Engineer, Polymer Group, Dept of Physics, University of Leeds
- 1981 - 1983 Technical Officer, R & D Plastics Section, IMI plc, Witton, Birmingham

Honours, awards and invitations

- Adjunct Professor, Mechanical & Aerospace Engineering, West Virginia University, USA
- Invited Guest Professor, Huazhong University of Science and Technology (HUST), Wuhan, China
- Invited Visiting Scientist, Friedrich Alexander University of Erlangen-Nuremberg, Germany (2009)
- Invited Visiting Speaker, Swedish National Graduate School in Tribology, Lulea, Sweden (2009)
- Tutor on the annual Cambridge Tribology Course
- Visiting Professor, Polymer Science & Engineering, University of Massachusetts, Amherst, USA (2000-05)
- Invited Visiting Scientist, DSM Engineering Plastics, Geleen, Netherlands (2004)
- Invited Speaker, The Polymer Science of Everyday Things, 225th ACS National Meeting, New Orleans (2003)
- Committee Member SPIE International Conference on Mechanical Reliability of Optical Fibres, (2000 - 2006)
- Engineering Foresight Award, Royal Academy of Engineering (2000)
- Manufacturing Engineer Journal Premium, IEE (1992)

Teaching

- MT1 PAM Properties and Applications of Materials
- MT2PECb Polymer Engineering and Composites
- 2PCS Polymer Case Study
- MT3MCMa Materials Characterisation and Design for Manufacture (including Artefact Case Study)
- Advanced Materials for BMedSci Biomedical Materials Science
- Final-year projects
- MEng Advanced Polymer Systems
- MRes/EngD Polymers and Soft Matter
- MRes/EngD Communications Skills
- MRes/EngD Ethics for Engineers

Research

Polymer Tribology

Friction and wear of engineering polymers, particularly under non-conformal, rolling-sliding contact as found in gears, cams and pulleys.

Flexible Displays

Properties and manufacture of thin films of transparent conducting oxides on polymer substrates for flexible display, touch-screen and related applications (plastic electronics).

Biomedical Engineering

Fracture and fatigue in medical grade elastomers for small joint arthroplasties; viscoelasticity in polymers for bioengineering.

Optical Fibre Sensors

Mechanical reliability of optical fibres and sensors for smart structures including fracture, fatigue, stress corrosion and statistics of failure.

Blends, Copolymers and Cyclic Polymers

Morphology and properties of blends and copolymers of engineering polymers.

Other activities

Deputy Head of School of Metallurgy and Materials involved in a variety of activities throughout the School.

Senior Tutor responsible for tutorial arrangements, Personal Tutors and the Transition Review in the School.

Course Tutor for BEng/MEng in Mechanical and Materials Engineering responsible for liaison with the School of Mechanical Engineering.

Welfare Tutor (postgraduate) responsible for student welfare issues, extensions, leave of absence and links with the University support services.

Coordinator of Chinese partnerships for undergraduate direct-entry engineering recruitment in the College of Engineering and Physical Sciences. Annual visits and all students interviewed in China for Materials and for Mechanical Engineering (in parallel with staff from Electrical, Electronic and Computer Engineering). Current partners include: Fudan University (Shanghai); Huazhong University of Science and Technology (HUST, Wuhan); Central South University (CSU, Changsha); Harbin Institute of Technology (HIT, Harbin and Weihai); Beijing University of Chemical Technology (BUCT, Beijing); Shanghai Jiao Tong University (SJTU); Wuhan University of Technology (WUT).

Coordinating, designing and teaching an annual, one-week, summer induction course for direct-entry students of Mechanical Engineering in Wuhan at HUST (since 2009).

Formerly Deputy Chair of the University Prima Facie Appeals Panel, Chair and Member of Appeals Hearing Panels (1998-2012).

Trained and participating in Misconduct Hearings for students and in both Conducting Investigations and Conducting Hearings and Appeals for Staff Discipline and Grievances. Taking part in Mediation meetings.

Director of the International Summer Energy School (ISES) in Birmingham for US high-school science teachers as part of the West Virginia University Research Experience for Teachers (RET) program funded by the National Science Foundation (2010-2012).

External Examiner for taught courses (BSc, BEng, MSc):

- University of North London (1995-2000)
- Bradford University (2004-2008)
- Open University (2010-2014)
- University of Central Lancashire, including partner college in Oman, (2011-2015)

External Examiner for research degrees: Universities of Glamorgan, Bradford, North London, Sheffield, Warwick, Brighton, University of the West of England (UWE) and RMIT, Melbourne.

Registered Expert Assessor, Quality and Qualifications Ireland (QQI).

External Assessor and Validation: Open University; Teesside University (Bradford College); Athlone Institute of Technology.

Institute of Physics (IoP): Chair of Tribology Group (2008-20011); Group Coordination Committee (2009-2012).

Institute of Materials, Minerals and Mining (IoMMM): Accreditation and Professional Development Committee (2014 -); Materials Education and Membership Working Parties (1992-1996); Member of Corporate Membership Committee, (1992-2002); Interviewer and Chair of Professional Review Panels for Fellowship, Membership and CEng. Accreditation Panels at Manchester University, Loughborough University, Trowbridge College.

Institution of Mechanical Engineers (IMechE): Member of Worcester Area Committee; Representing Worcester Area on Midlands Committee.

Member of the Society of Information Display (SID)

Member of the American Society of Engineering Education (ASEE)

Publications

Selected Publications

Book Chapter

K D Dearn, S N Kukureka and D Walton, 'Engineering Polymers and Composites for Machine Elements', Chapter 14 in S K Sinha and B J Briscoe (eds), *Polymer Tribology*, pp 470-505 (Imperial College Press, London, 2009).

Journal Papers since 2008

T J Hoskins, K D Dearn, Y K Chen, S N Kukureka, 'The wear of PEEK in rolling-sliding contact – simulation of polymer gear applications', *Wear*, **309**, 35-42 (2014).

S A Samsudin, S N Kukureka, M J Jenkins, 'The equilibrium melting temperature and isothermal crystallisation kinetics of cyclic poly(butylene terephthalate) and styrene maleimide (c-PBT/SMI) blends', *Journal of Thermal Analysis and Calorimetry*, **114**, 1307-1315 (2013).

N Metje, A M Kolonko, D N Chapman, D Cheneler, S N Kukureka, 'Methodology for the Preparation of Polymer Samples Containing Silicon Microchips for Mechanical Testing', *Polymer-Plastics Technology and Engineering*, **52**, 461-471 (2013).

G A Potoczny, T S Bejital, J S Abell, K A Sierros, D R Cairns, S N Kukureka, 'Flexibility and electrical stability of polyester-based device electrodes under monotonic and cyclic buckling conditions', *Thin Solid Films*, **528**, 205-212 (2013).

T S Bejital, D Compton, K A Sierros, D R Cairns, S N Kukureka, 'Electromechanical reliability of flexible transparent electrodes during and after exposure to acrylic acid', *Thin Solid Films*, **528**, 229-236 (2013).

A M Kolonko, N Metje, D N Chapman, S N Kukureka, 'Impact of Millimetre Size Silicon Microchips on the Mechanical Properties of Polymer Samples Tested under Flexural Bending, Long-Term Creep and Impact Conditions', *Journal of Pipeline Systems Engineering and Practice*, **4**, 115-123 (2013).

A M Kolonko, N Metje, D N Chapman, S N Kukureka, 'Tensile properties of polymer samples containing millimetre scale silicon microchips', *Polymers and Polymer Composites*, **20**, 505-516 (2012).

S A Samsudin, S N Kukureka, M J Jenkins, 'Miscibility in cyclic poly (butylene terephthalate) and styrene maleimide (c-PBT/SMI) blends prepared by solid-dispersion and in situ polymerisation of cyclic butylene terephthalate oligomers (CBT) within SMI', *Journal of Applied Polymer Science*, **126**, S12, E290-E297 (2012).

C L Davis, S N Kukureka, 'Effect of materials and manufacturing on the bending stiffness of vaulting poles', *Physics Education*, **47**, 524-529 (2012).

A J Kessman, S N Kukureka, D R Cairns, 'Tribology of non-wetting, fluorinated, mesoporous silica films', *Wear*, **271**, 2144-2149 (2011).

K A Sierros, T S Bejital, S Cronin, A J Kessman, S N Kukureka, D R Cairns, 'Tribo-corrosion of Ag and Ag-alloy ITO multilayers used in solar energy applications', *Wear*, **271**, 1438-1444 (2011).

T J Hoskins, K D Dearn, S N Kukureka, D Walton, 'Acoustic noise from polymer gears: a tribological investigation', *Materials and Design*, **32**, 3509-3515 (2011).

A Mahomed, D W L Hukins, S N Kukureka, D E T Shepherd, 'Effect of accelerated aging on the viscoelastic properties of Elast-Eon®: a polyurethane with soft poly(dimethylsiloxane) and poly(hexamethylene oxide) segments', *Materials Science and Engineering C* **30**, 1298-1303, (2010).

A Mahomed, D W L Hukins, S N Kukureka, 'Swelling of medical grade silicones in liquids and calculation of their cross-link densities', *Medical Engineering and Physics*, **32**, 298-303 (2010).

K A Sierros, D R Cairns, J S Abell, S N Kukureka 'Pulsed laser deposition of indium tin oxide films on flexible polyethylene naphthalate display substrates at room temperature', *Thin Solid Films*, **518**, 2623-2627 (2010).

A Mahomed, D W L Hukins, S N Kukureka, 'Viscoelastic properties of Silastic® medical-grade silicones: Implications for finger-joint replacement', *Journal of Polymer Materials*, **26**, 389-399, (2009).

K A Sierros and S N Kukureka, 'Mechanical integrity of touch-screen components', *Journal of the Society of Information Display*, **17**, 947-952 (2009).

A Mahomed, N M Chidi, D W L Hukins, S N Kukureka, D E T Shepherd, 'Frequency dependence of viscoelastic properties of medical grade silicones', *Journal of Biomedical Materials Research Part B: Applied Biomaterials*, **89B**, 210-216 (2009).

R S Mahendran, L Wang, V R Machavaram, S D Pandita, R Chen, S N Kukureka and G F Fernando, 'Fiber-optic sensor design for chemical process and environmental monitoring', *Optics and Lasers in Engineering*, **47**, 1069-1076 (2009).

A Mahomed, D W L Hukins, S N Kukureka, 'Viscoelastic properties of medical grade silicones in tension', *Journal of Polymer Materials*, **26**, 199-206 (2009).

D H Gordon, S N Kukureka, 'The wear and friction of PA 46 and PA 46 / aramid-fibre composites in sliding-rolling contact', *Wear*, **267**, 669-678 (2009).

A J Kessman, D K P Huckaby, C R Snyder, S N Kukureka, D R Cairns, 'Tribology of wear-resistant, sol-gel coatings for optical applications', *Wear*, **267**, 614-618 (2009).

K A Sierros, N J Morris, S N Kukureka, D R Cairns, 'Dry and wet sliding wear of ITO coated PET components used in flexible optoelectronic applications', *Wear*, **267**, 625-631 (2009).

D W L Hukins, A Mahomed, S N Kukureka, 'Accelerated aging for testing polymeric biomaterials and medical devices', *Medical Engineering and Physics*, **30**, 1270-1274 (2008).

L J Leslie, S N Kukureka, D E T Shepherd, 'Crack-growth of medical-grade silicone using pure shear tests', *Proceedings of the IMechE, Part H Journal of Engineering in Medicine*, **222**, 977-982 (2008).

L J Leslie, M J Jenkins, D E T Shepherd, S N Kukureka, 'The effect of the environment on the mechanical properties of medical grade silicones', *Journal of Biomedical Materials Research Part B: Applied Biomaterials*, **86B**, 460-465 (2008).

Published Conference papers since 2008

A Mahomed A, D W L Hukins, S N Kukureka, D E T Shepherd, 'Viscoelastic properties of elastomers for small joint replacements', 13th International Conference in Biomedical Engineering, Singapore, *International Federation of Medical and Biological Engineering Proceedings*, **23**, 1191-1194, (2009).

R S Mahendran, R Chen, S N Kukureka, G F Fernando, 'Monitoring and modelling the diffusion profile in a thermosetting resin', in *Smart Sensor Phenomena, Technology, Networks and Systems 2009*, eds N G Meyendorf, K J Peters, W Ecke, *Proc SPIE*, **7293**, 729319 (2009).

D Harris, R S Mahendran, D Brooks, F A A Al-Khodairi, V R Machavaram, P Reynolds, L Wang, S D Pandita, M Paget, J Wedderburn, S A Malik, S O Ojo, S N Kukureka, G F Fernando, 'Self-sensing, self-healing, and crack-arrestor composites', in *Smart Sensor Phenomena, Technology, Networks and Systems 2009*, eds N G Meyendorf, K J Peters, W Ecke, *Proc SPIE*, **7293**, 72930P (2009).

R S Mahendran, V R Machavaram, L Wang, J M Burns, D Harris, S N Kukureka, G F Fernando, 'A novel multifunctional fibre optic sensor', in *Smart Sensor Phenomena, Technology, Networks and Systems 2009*, eds N G Meyendorf, K J Peters, W Ecke, *Proc SPIE*, **7293**, 72930C (2009).

N J Morris, K A Sierros, K Ramji, D R Cairns, S N Kukureka, 'Mechanical assisted corrosion: An investigation of thin film components used in flexible optoelectronic applications', *Society of Information Display International Symposium Digest of Technical Papers*, **39**, 1461-1464 (2008).

K A Sierros, N J Morris, J S Abell, D R Cairns, S N Kukureka, 'Mechanical integrity of hybrid components used in flexible optoelectronic devices', *Materials Research Society Symposium Proceedings*, **1075**, J04-04 (2008).

R Mahendran, R Chen, L Wang, S D Pandita, V R Machavaram, S N Kukureka, G F Fernando, 'Chemical process monitoring and the detection of moisture ingress in composites', *Smart Sensor Phenomena, Technology and Systems*, eds W Ecke, K J Peters, N G Meyendorf, *Proc SPIE*, **6933**, 9330 (2008).

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