Darran Robert Cairns PhD **cairnsd@umkc.edu**
1608 SE 2nd Terrace Lees Summit, MO, 64063 **(304) 216-9363**

Education

1999 **PhD Materials Science**
University of Birmingham, Edgbaston, Birmingham, United Kingdom

1995 **BSc Physics**
University of Birmingham, Edgbaston, Birmingham, United Kingdom

2023 (expected) **MA Educational Psychology**
West Virginia University, Morgantown, West Virginia

2020 **Graduate Certificate Program Evaluation**
West Virginia University, Morgantown, West Virginia

Professional

2019 **FIMMM**
Institute of Materials, Mineral, and Mining

2019 **FInstP**
Institute of Physics

Research Experience

2019-Present **Associate Professor**
University of Missouri – Kansas City, Civil & Mechanical, Kansas City, MO, USA

- Advanced manufacturing.
- Plastics manufacturing.
- Materials engineering.
- Flexible Laminate Electronics.
- Sensors and Touch Screens
- Display and Lighting Materials.
- Wearable devices.
- 3D Printing.
- Robotic Deposition.
- Engineering Education
- Design Based Learning

2019-present **Director SCE Math Academy**

- Engineering Education.
- STEM Education.
- Education Research.
- Access & Equity.
- Program Evaluation.

2014-Present **CEO and Founder**
Tailored Surfaces, Morgantown, WV, USA

- Solution based processing of smart materials.
- Micro and nano-composite materials.
- Liquid crystalline materials and composites.
- Flexible Laminate Electronics.
- Sensors and Touch Screens.
- Display Materials and Optical Components.

2006-Present **Associate Professor in Mechanical Engineering (Adjunct Associate Professor since August 2014)**
West Virginia University, Mechanical & Aerospace, Morgantown, WV, USA

- Liquid crystal polymers.
- Plastic films based electronics.
- Solution based processing of composite materials.
- Micro and nano-composite materials.
- Liquid crystalline materials and composites.
- Flexible Laminate Electronics.
- Sensors and Touch Screens
- Display and Lighting Materials.

2001-2005 **Research Specialist**
3M Touch Systems, Optical Systems Division, Methuen, MA, USA

- Touch Sensors
- Polymer materials and manufacturing
- Glass materials and manufacturing
- High performance coatings for mechanical protection of displays and touch sensors.

- Metallization of organic and inorganic transparent conducting films
- Development of wear resistant composite sol-gel optical coatings
- Degradation mechanisms of functional materials
- Processing-structure-properties relations of transparent conducting films
- High performance Pb-free nanoparticle based thick film ceramics.
- Micro-composite based adhesive systems for solder replacement.

1998-2001 **Postdoctoral Research Associate in Engineering**
Brown University, Division of Engineering, Providence, RI, USA

- Opto-mechanical properties of organic functional materials.
- Polymer based displays.
- Polymer composites.
- Electrical and mechanical properties of functional transparent conducting materials on polymers for flexible device applications.
- Fabrication and characterization of organic passive optical components for information displays.
- Self-assembled polymer electro-optical meso-structures from reactive liquid crystal monomers.
- Fabrication and characterization of strain sensors from liquid crystal-polymer composites.
- Flexible and conformable information displays.
- Physical aging of liquid crystalline materials.

1995-1998 **Graduate Student in Metallurgy & Materials**
University of Birmingham, Edgbaston, Birmingham, UK

- Dissertation title "The mechanical reliability of silica optical fibres."

- Experimental and statistical analysis of mechanical failure of optical fibres in aqueous environments. Sponsored by Pirelli Cables UK Ltd.

Teaching Experience

1999-2005 **Adjunct Assistant Professor in Engineering**
Brown University, Division of Engineering, Providence, RI, USA

- Course title: Structure and Properties of Non-Metallic Materials
- Full responsibility for course development
- Upper level class primarily Seniors and Graduate Students

2000 **Adjunct Assistant Professor in Physics**
University of Massachusetts, Department of Physics, Dartmouth, MA, USA

- Course title: 2nd Semester Physics (Electric Circuits and Electromagnetism) for modern physics program
- Studio based teaching approach with all teaching performed in the laboratory.

1995-1998 **Teaching Assistant in Mathematics and Engineering**
University of Birmingham, Edgbaston, Birmingham, UK

- TA for Department of Mathematics engineering mathematics courses.
- Laboratory demonstrator for numerical and computational methods course including development of laboratory assignments.
- Laboratory demonstrator for polymer processing laboratory
- TA for composite beam design experiment.

Educational Outreach

1998-2001 **Postdoctoral Research Associate in Engineering**
Brown University, MRSEC, Providence, RI, USA

- Developed course materials for MRSEC educational outreach activities.
- Instructor in MRSEC educational outreach to youth groups including Providence Boys and Girls Club and the Providence Bridge School
- Instructor in Brown Universities MRSEC Educational Institute for high school science teachers
- Day-to-day supervision of seven undergraduate students as part of Brown Universities summer research experience program for undergraduates

Achievements

Winner UMKC Good Teaching Award Civil & Mechanical Engineering 2022
Winner Weaver Award for Excellence in Mechanics Education at WVU 2008
Paper selected for Best Papers of Society for Information Display 2003
Visiting Assistant Professor in Engineering Brown University 2003-04
University of Birmingham Honorary Research Fellow in Engineering 2002-05
(Promoted to Honorary Senior Research Fellow Jan 1st 2006)
Chapter Chair of New England Chapter of The Society for Information Display
Co-inventor of 12 issued US Patents
Regional Winner Institute of Materials National Lecture Competition 1998
University of Birmingham Postgraduate Faculty Student Liaison Committee
Pirelli Cables Graduate Student Fellowship 1995-1998
Plenary Speaker, NordTrib, Lulea, Sweden, June 2010

Professional Service

Editor of two Special Sections of the Journal of the SID on 3D Displays and Interactive Displays
Chapter Chair of New England Chapter of The Society for Information Display

Program Committee Member Society for Information Display International Symposium (2004 – 2007)
Program Committee Member International Display Research Conference 2006
Reviewer for Thin Solid Films, Surface Coatings and Technology, Materials Science Letters, Smart Materials and Structures and The Journal of the SID.
Supported Economic Development through Product Development Projects with Grote, CP Films (now Solutia) and EuropTec USA.
Classroom Instruction in Physics at Fairmont Senior High School
Director of NSF RET Site in Energy and the Environment

Learned Societies

Institute of Physics, CPhys, FInstP
Institute of Materials, Minerals, and Mining, FIMMM
Society for Information Display
American Society for Engineering Education
American Society of Mechanical Engineers

Sources of Grant Funding

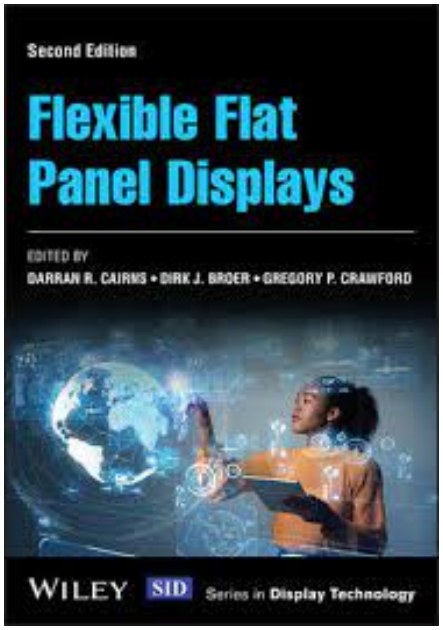
NSF, NASA, AFOSR, DOE, West Virginia Higher Education Policy Commission, West Virginia Department of Education, Solutia, Grote Industries, EuropTec USA, West Virginia University, Kopp Glass.

Publications

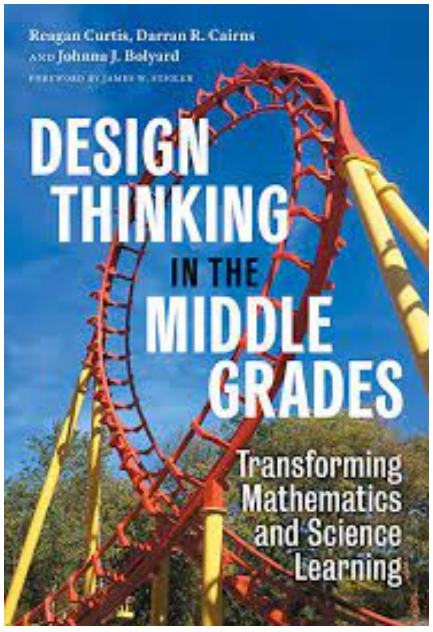
Publications (2 Books, 6 Book Chapters, 46 Journal Publications, 34 Conference Papers, 13 Patents, 2800+ Citations, 26 H-Index)

Books

[B2] D. R. Cairns, G. P. Crawford and D. J. Broer, Eds., "Flexible Flat Panel Displays", 2nd Edition, Wiley (2023).



[B1] R. P. Curtis, D. R. Cairns and J. J. Bolyard, "Design Thinking in the Middle Grades: Transforming Math and Science Learning", Teachers College Press (2023).



Book Chapters

[BC6] D. R. Cairns, G. P. Crawford and D. J. Broer, "Overview of Flexible Flat Panel Displays", in Flexible Flat Panel Displays, 2nd Edition, D. R. Cairns, G.P. Crawford and D. J. Broer Editors, Wiley, (2023).

[BC5] D. R. Cairns, and A. Weiss, "Interacting with Flexible Displays", in Flexible Flat Panel Displays, 2nd Edition, D. R. Cairns, G.P. Crawford and D. J. Broer Editors, Wiley, (2023).

[BC4] K. A. Sierros and D. R. Cairns, "Direct Ink Writing of Touch Sensors and Displays", in Flexible Flat Panel Displays, 2nd Edition, D. R. Cairns, G.P. Crawford and D. J. Broer Editors, Wiley, (2023).

[BC3] N. Winch, D. R. Cairns, and K.A. Sierros, "Flexible Battery Fundamentals", in Flexible Flat Panel Displays, 2nd Edition, D. R. Cairns, G.P. Crawford and D. J. Broer Editors, Wiley, (2023).

[BC2] D. R. Cairns, M. E. Sousa and G. P. Crawford, "Responsive Reactive Mesogen Microstructures", in Crosslinked Liquid Crystalline Systems: From Rigid Polymer Networks to Elastomers, D. J. Broer, G.P. Crawford, and S. Zumer, Eds., Taylor and Francis, (2011).

[BC1] D. R. Cairns, "Mechanical Reliability of Conductive Polymers for Rollable Display Applications" in Flexible Flat Panel Displays, G. P. Crawford Editor, Wiley, (2005).

Journal

[J46] J. J. Bolyard, R. Curtis, D. R. Cairns, T. Mikalik, (2022). Learning to struggle, struggling to learn: coming to understand and promote productive struggle in middle grades STEM teaching and learning. International Journal of Science and Mathematics Education, (submitted).

[J45] D. R. Cairns, R. Curtis, K. A. Sierros, J. J. Bolyard, (2018). Taking Professional Development From 2D to 3D: Design-Based Learning, 2D Modelling, and 3D Fabrication for Authentic Standards-Aligned Lesson Plans. Interdisciplinary Journal of Problem-Based Learning, 12(2). Available at: https://doi.org/10.7771/1541-5015.1759.

[J45] D. A. Banerjee, A. J. Kessman. D. R. Cairns, K. A. Sierros, "Tribology of silica nanoparticle-reinforced, hydrophobic sol-gel composite coatings" Surface Coatings and Technology **260** p215 (2014).

[J44] G. Kiriakidis, I. Kortidis, S. Cronin, N. J. Morris, D. R. Cairns, K. A. Sierros, "Tribological investigation of piezoelectric ZnO films for rolling contact based energy harvesting and sensing applications" Thin Solid Films **555** p68 (2014).

[J43] T. S. Bejitual, N. J. Morris, D. R. Cairns, K. A. Sierros, "Controlled buckling behavior of patterned oxide structures on compliant substrates for flexible electronics" Thin Solid Films **549** p268 (2013).

[J42] T. S. Bejitual, N. J. Morris, S. D. Cronin, D. R. Cairns, K. A. Sierros, "Mechano-chemical degradation of flexible electrodes for optoelectronic device applications" Thin Solid Films **549** p251 (2013).

[J41] T. S. Bejitual, D. Compton, K. A. Sierros, D. R. Cairns and S. N. Kukureka, "Electromechanical reliability of flexible transparent electrodes during and after exposure to acrylic acid" Thin Solid Films **528** p229 (2013).

[J40] G. A. Potoczny, T. S. Bejitual, J. S. Abell, K. A. Sierros, D. R. Cairns and S. N. Kukureka "Flexibility and electrical stability of polyester-based device electrodes under monotonic and cyclic buckling conditions", Thin Solid Films **528** p205 (2013).

[J39] A. J. Kessman, E. Defusco, A. W. Hoover, K. A. Sierros and D. R. Cairns, "Structural, mechanical, and tribological properties of silica films with encapsulated hydrophobic functionality: effect of functional moiety and surfactant template concentrations", Thin Solid Films **520** p3896 (2012).

[J38] A. J. Kessman, E. DeFusco, A. W. Hoover, K. A. Sierros, D. R. Cairns, "Sustained Protection for Transparent Electrodes in Touch Panels and Smart Windows: Template Assisted Encapsulation of Fluorinated Silanes in Sol-Gel Silica Films for Sustained Hydrophobic-Oleophobic Functionality" Materials Research Society Symposium Proceedings, 1400, Mrsf11-1400-s05-03. doi:10.1557/opl.2012.91.

[J37] T. S. Bejitual, K. Ramji, A. J. Kessman, K. A. Sierros and D. R. Cairns, "Degradation of an amorphous indium tin oxide film in acrylic acid", Materials Chemistry and Physics **132** p395 (2012).

[J36] J M Gutiérrez, E J Barbero, D R Cairns, V H Mucino and J A Mayugo, "Dynamic roughness and power dissipation of polymer films actuated with liquid crystal polymer inclusions", Smart Materials and Structures **21** p015003 (2012).

[J35] K. A. Sierros, T. S. Bejitual, S. Cronin, A. J. Kessman, S. N. Kukureka and D. R. Cairns, "Tribo-corrosion of Ag and Ag-alloy ITO multilayers used in solar energy applications", Wear **271** p438 (2011).

[J34] A. J. Kessman, S. N. Kukureka and D. R. Cairns, "Tribology of fluorinated mesoporous silica films", Wear **271** p2144 (2011).

[J33] A. J. Kessman and D. R. Cairns, "Template-assisted encapsulation of fluorinated silanes in silica films for sustained hydrophobic-oleophobic functionality", Journal of Colloid and Interface Science, **360** p785 (2011).

[J32] K. A. Sierros, N. J. Morris, R. Nair, N. X. Randall, and D. R. Cairns, "Spherical indentation and scratch durability studies of transparent conducting layers on polymer substrates", Thin Solid Films, **520** p424 (2011).

[J31] A. J. Kessman and D. R. Cairns, "Microtribological study of internal surfaces of fluorinated mesoporous silica films", Langmuir, **27** p5968 (2011).

[J30] D. S. Hecht, K. A. Sierros, L. Hu, C. Niu, R. S Lee, D. A. Banerjee and D. R. Cairns, "Transparent conductive carbon nanotube films directly coated onto flexible and rigid polycarbonate", Journal of the Society for Information Display **19** p157 (2011).

[J29] K. A. Sierros, D. A. Banerjee, N. J. Morris, D. R. Cairns, I. Kortidis and G. Kiriakidis, "Mechanical properties of ZnO thin films deposited on polyester substrates used in flexible device applications", Thin Solid Films **519** p325 (2010).

[J28] D. R. Cairns, M. S. Shafran, K. A. Sierros, W. W. Huebsch, A. J. Kessman,

"Stimulus-responsive fluidic dispersions of rod shaped liquid-crystal polymer colloids", Materials Letters **10** p1133 (2010).

[J27] K. A. Sierros, D. S. Hecht, D. A. Banerjee, N. J. Morris, L. Hu, G. C. Irvin, R. S Lee and D. R. Cairns, "Durable transparent carbon nanotube films for flexible device components" Thin Solid Films **518** p6977 (2010).

[J26] K. A. Sierros, D. R. Cairns, J. S. Abell and S. N. Kukureka, "Pulsed laser deposition of indium tin oxide films on flexible polyethylene naphthalate display substrates at room temperature". Thin Solid Films **518** p2623 (2010).

[J25] A. J. Kessman, D. R. Cairns, P. J. Richter, F. J. Bottari, "Mesostructured island formation in sol–gel SiO_2 films through controlled, concentration-dependent flocculation of colloidal silica particles", Materials Letters **64**, p258 (2010).

[J24] A. J. Kessman, K. Ramji, N. J. Morris, D. R. Cairns, "Zirconia sol–gel coatings on alumina– silica refractory material for improved corrosion resistance" Surface and Coatings Technology **204**, p477 (2009).

[J23] K. A. Sierros, N. J. Morris, K. Ramji and D. R. Cairns, "Stress-corrosion cracking of indium tin oxide coated polyethylene terephtalate for flexible optoelectronic devices", Thin Solid Films **517**, p2590 (2009).

[J22] A. J. Kessman, D. K. P. Huckaby, C. R. Snyder, S. N. Kukureka and D. R. Cairns, "Tribology of water and oil repellent sol-gel coatings for optical applications", Wear **267**, p614 (2009).

[J21] K. A. Sierros, N. J. Morris, S. N. Kukureka and D. R. Cairns, "Dry and wet sliding wear of ITO coated PET components used in flexible optoelectronic applications", Wear **267**, p625 (2009).

[J20] M. Shafran, K. A. Sierros, W. W. Huebsch, D. R. Cairns, "Electrically switchable liquid crystal polymer rod actuators" Materials Research Society Symposium Proceedings, 1096, FF03-07 (2008).

[J19] 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).

[J18] D. R. Cairns, P. J. Richter, A. J. Kessman, F. J. Bottari and N. X. Randall, "Mechanical and tribological investigations of sol-gel derived SiO2 optical coatings", Wear **265**, p411 (2008).

[J17] K. Ramji, D. R. Cairns & S. Rajeswari "Synergistic inhibition effect of 2-mercaptobenzothiazole and Tween-80 on the corrosion of brass in NaCl solution", Applied Surface Science **254**, p4483 (2008).

[J16] D. R. Cairns, "Introduction: Special Section on 3-D Displays" J. Soc. Inf. Display **15**, p859 (2007).

[J15] D. R. Cairns and G. P. Crawford, "Electro-mechanical properties of transparent conducting substrates for flexible electronic displays", Proceedings of the IEEE, **93**, p1451 (2005).

[J14] M. J. Escuti, D. R. Cairns and G. P. Crawford, "Optical-strain characteristics of anisotropic polymer films fabricated from a liquid crystal diacrylate" Journal of Applied Physics **95**, p2386 (2004).

[J13] S. P. Gorkhali, D. R. Cairns and G. P. Crawford, "Flexible transparent conducting substrates for rollable displays: a cyclic loading study", Journal of the Society for Information Display **12**, p45 (2004).

[J12] D. R. Cairns, S. P. Gorkhali, S. Esmailzadeh, J. Vedrine, and G. P. Crawford, "Conformable displays based on Polymer Dispersed Liquid Crystal Materials on Flexible Substrates", Journal of the Society of Information Display, **11**, p289 (2003).

[J11] D. R. Cairns, M. Sibulkin and G. P. Crawford, "Switching dynamics of suspended mesogenic polymer microspheres" Applied Physics Letters, **78**, p2643 (2001).

[J10] D. R. Cairns, D. C. Paine and G. P. Crawford, "The mechanical reliability of indium tin oxide coated polymer substrates for flexible

displays and touchscreens" MRS proceedings, 666, F3.24.1-F3.24.12 (2001).

[J9] N. A. Bailey, D. R. Cairns, G. P. Crawford, and J. N. Hay "A study of enthalpic relaxation of a Liquid Crystal " Liquid Crystals, **28**, p1761 (2001).

[J8] S. N. Kukureka, A. Pedicini and D. R. Cairns, "Embedded fiber-optic sensors: performance aspects and the single-fiber fragmentation test" Proceedings of SPIE Vol 4215, p 218-224 (2001).

[J7] S. N. Kukureka and D. R. Cairns, "A comparison of the distribution of estimated weibull parameters from optical fiber strength measurements", Proceedings of SPIE Vol 4215, p 90-97 (2001).

[J6] D. R. Cairns, S. M. Sachsman, D. K. Sparacin, R. P. Witte II, G. P. Crawford and D. C. Paine "Mechanical behavior of indium oxide thin films on polymer substrates" in Thin Films VIII–Stresses and Mechanical Properties, Editors R. Vinci, O. Kraft, N. Moody, P. Besser and E. Shaffer II, p401 (2000).

[J5] D. R. Cairns, N. S. Eichenlaub and G. P. Crawford, "Ordered polymer microstructures synthesized from dispersions of liquid crystal mesogens", Molecular Crystals and Liquid Crystals, **351**, p379 (2000).

[J4] D. R. Cairns, C. C. Bowley, S. Danworaphong, A. K. Fontecchio and G. P. Crawford, "Optical Strain Characteristics of Holographically-Formed Polymer-Dispersed Liquid Crystal Films" Applied Physics Letters **77**, p2677 (2000).

[J3] D. R. Cairns, R. P. Witte II, D. K. Sparacin, S. M. Sachsman, D. C. Paine, G. P. Crawford and R. R. Newton "Strain-dependent electrical resistance of tin doped indium oxide on polymer substrates*"* Applied Physics Letters, **76**, p1425 (2000).

[J2] S. N. Kukureka and D. R. Cairns, "Statistical analysis methods for strength distributions in optical fibres", in Optical Fiber Reliability and Testing, M John Matthewson, Editor, Proceedings of SPIE Vol 3848, p 17 (1999).

[J1] D. R. Cairns, G. M. Genin, A. J. Wagoner, C. L. Briant and G. P. Crawford, "Amplified strain-rate dependence of deformation in Polymer Dispersed Liquid Crystal materials", Applied Physics Letters, **75**, p1872 (1999).

Books and Book Chapters

[B2] R. P. Curtis, D. R. Cairns and J. J. Bolyard, "Developing Creative STEM Thinkers: Engineering Design and Mathematical Modeling in the Middle Grades", Teachers College Press (to be published in 2023).

[B1] D. R. Cairns, G. P. Crawford and D. J. Broer, Eds., "Flexible Flat Panel Displays", 2nd Edition, Wiley (to be published 2022).

[BC6] D. R. Cairns, G. P. Crawford and D. J. Broer, "Overview of Flexible Flat Panel Displays", in Flexible Flat Panel Displays, 2nd Edition, D. R. Cairns, G.P. Crawford and D. J. Broer Editors, Wiley, (2022).

[BC5] D. R. Cairns, and A. Weiss, "Interacting with Flexible Displays", in Flexible Flat Panel Displays, 2nd Edition, D. R. Cairns, G.P. Crawford and D. J. Broer Editors, Wiley, (2022).

[BC4] K. A. Sierros and D. R. Cairns, "Direct Ink Writing of Touch Sensors and Displays", in Flexible Flat Panel Displays, 2nd Edition, D. R. Cairns, G.P. Crawford and D. J. Broer Editors, Wiley, (2022).

[BC3] N. Winch, D. R. Cairns, and K.A. Sierros, "Flexible Battery Fundamentals", in Flexible Flat Panel Displays, 2nd Edition, D. R. Cairns, G.P. Crawford and D. J. Broer Editors, Wiley, (2022).

[BC2] D. R. Cairns, M. E. Sousa and G. P. Crawford, "Responsive Reactive Mesogen Microstructures", in Crosslinked Liquid Crystalline Systems: From Rigid Polymer Networks to Elastomers, D. J. Broer, G.P. Crawford, and S. Zumer, Eds., Taylor and Francis, (2011).

[BC1] D. R. Cairns, "Mechanical Reliability of Conductive Polymers for Rollable Display Applications" in Flexible Flat Panel Displays, G. P. Crawford Editor, Wiley, (2005).

Patents

[P13] A. J. Kessman and D. R. Cairns, "Hydrophobic and Oleophobic Coatings", 9,896,549 (2018).

[P12] D. R. Cairns, W. W. Huebsch, K. A. Sierros and M. S. Shafran, "Stimulus Responsive Nanoparticles", US 9,658,251 (2017).

[P11] D. R. Cairns, W. W. Huebsch, K. A. Sierros and M. S. Shafran, "Stimulus Responsive Nanoparticles", US 9,035,644 (2015).

[P10] D. R. Cairns, W. W. Huebsch, K. A. Sierros and M. S. Shafran, "Stimulus Responsive Nanoparticles", US 8,367,260 (2013).

[P9] P. J. Richter, D. R. Cairns and F. J. Bottari, "Wiring Harness and Touch Sensor Incorporating Same", US 8,194,044 (2012).

[P8] Paul J. Richter, D.R. Cairns and Frank J. Bottari, "Touch Screen Comprising Antiglare Coating Articles", US 8,003,194 (2011).

[P7] Paul J. Richter, D.R. Cairns and Frank J. Bottari, "Antiglare Coating and Articles", US 7,780,776 (2010).

[P6] Paul J. Richter, D.R. Cairns and Frank J. Bottari, "Antiglare Coating and Articles", US 7,736,428 (2010).

[P5] E. M. Cross, R. M. Moshrefzadeh, F. J. Bottari, A. F. Chernefsky, D. R. Cairns &, P. J. Richter "Capacitive touch screen with conductive polymer", US 7,477,242 (2009).

[P4] P. J. Richter, D. R. Cairns and F. J. Bottari, "Wiring Harness and Touch Sensor Incorporating Same", US 7,339,579 (2008).

[P3] Paul J. Richter, D. R. Cairns and Frank J. Bottari, "Antiglare Coating and Articles", US 7,294,405 (2007).

[P2] Paul J. Richter, D. R. Cairns and Frank J. Bottari, "Antiglare Coating and Articles", US 7,291,386 (2007).

[P1] G. P. Crawford, D. R. Cairns, C. C. Bowley, S. Danworaphong, A. K. Fontecchio S. M. Faris and L. Li, "Reflective Strain Gauge with Aspected Particles and Polarization Sensitive Devices" US 6,778,236 (2004).

Published Pending Patent Applications

[A1] Paul J. Richter, D. R. Cairns and Frank J. Bottari, "Antiglare Coating and Articles", US 11/863,317 (2007).

Conference

[C34] R. Curtis, D. Cairns, J. Bolyard, (2020, June), "Understanding Design, Tolerating Ambiguity, and Developing Middle School Design-based Lessons" Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual Online . 10.18260/1-2—35420.

[C33] M. Maher, K. O'Shea, J. M. Marszalek, D. Cairns, (2020, June), "Challenges in a Freshman General Education Class" Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual Online . 10.18260/1-2—34268.

[C32] R. Curtis, J. Bolyard, D. Cairns, K. L. Watts, D. L. Loomis, S. Mathew, "Building middle school teacher mathematics and science content knowledge through engineering design." Proceedings of the American Society for Engineering Education 2017 Annual Conference and Exposition.

[C31] R. Curtis, J. Bolyard, D. Cairns, K. L. Watts, D. L. Loomis, S. Mathew, "Middle school math and science teachers engaged in STEM and literacy through engineering design." Proceedings of the American Society for Engineering Education 2017 Annual Conference and Exposition.

[C30] R. Curtis, J. Bolyard, D. Cairns, K. L. Watts, D. L. Loomis, S. Mathew, M. Carte, "Integrating STEM and literacy through engineering design: Evaluation of professional development for middle school math and science teachers." Proceedings of the American Society for Engineering Education 2016 Annual Conference and Exposition.

[C29] Z. Georgieva, R. Curtis, T. A. S. Saenz, M. D. Solley, D. Cairns, "Impact of attending a research experience for teachers program with international and societally relevant components" 120th ASEE Annual Conference and Exposition; Atlanta, GA; United States; 23 June 2013 through 26 June 2013

[C28] K. A. Sierros, D. R. Cairns, D. S. Hecht, C. Ladous, R. Lee, C. Niu, 'Highly durable transparent carbon nanotube films for flexible displays and touch screens', Society of Information Display Digest of Technical Papers, 41, 882 (2010).

[C27] K. A. Sierros, D. A. Banerjee, D. R. Cairns, R. Bozich, 'Durable solid state flexible LED devices', Society of Information Display Digest of Technical Papers, 41, 1942 (2010).

[C26] N. J. Morris, K A. Sierros, R. Nair, N. X. Randall, D. R. Cairns, "Scratch and indentation of indium tin oxide films on polyester substrates", Wear of Materials, Las Vegas, NV, April 19th- 22nd 2009.

[C25] D. K. P. Huckaby and D. R. Cairns, "Quantifying "Sparkle" of anti-Glare surfaces", Society of Information Display Digest of Technical Papers, 40, 511 (2009).

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Prior Testimony Last 5 Years

2022 **Samsung v Power2B, Multiple IPRs: 2022-00325; 2022-00315; 2022-0034; 2022-00405; 2022-00300; 2021-01190; 2021-01257; 2021-01266; 2021-01239; 01220**
Retained as a testifying expert by Power2B to provide expert advice on touch input sensors. Prepared expert reports. Testified at deposition.

2021 **Class v Apple., 5:18-CV-02813-EJD U.S. District Court, Northern District of California**
Retained as a testifying expert by Apple to provide expert advice on butterfly keyboard mechanisms used in certain MacBook keyboards. Prepared expert reports. Testified at deposition.

Panasonic Corporation v Getac Technology Corp., 8:19-cv-01118-doc-dfm, U.S. District Court, Central District of California
Retained as a testifying expert by Getac to provide expert advice on manufacturing and mechanical reliability of ruggedized laptops. Prepared expert reports. Testified at deposition.

2020 **Axioma Metering UAB v Kamstrup, IPR US Patent Number 8,806,957**
Retained as a testifying expert by Kamstrup to provide expert advice on molding of polymer structures for sensor housing. Prepared expert reports. Testified at deposition.

2019 **Reactive Surfaces Ltd. LLP v LG Chem Ltd, IPR US Patent Number 8,932,717**
Retained as a testifying expert by LG Chem to provide expert advice on manufacture of coated surfaces. Prepared expert reports and deposition testimony. Testified at deposition.

Nartron v Apple, IPR US Patent Number 5,796,183
Retained as a testifying expert by Nartron to provide expert advice on touch sensors. Prepared expert reports and deposition testimony.