Exponent®
Engineering & Scientific Consulting

James Frake, Ph.D., CPhys, FSaRS

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Professional Profile

Dr. Frake is an experienced engineering physicist who has provided multidisciplinary technical consulting services to clients in systems-level engineering, failure analysis, safety / reliability, risk management, research & development, and testing of products. He works across all stages of the product lifecycle to encourage a holistic approach in the product development process for product innovation, safety, and reliability. Dr. Frake has worked extensively in the fields of batteries, medical devices, and sensing / metrology and is experienced in failure investigations and standards / regulatory compliance for products and manufacturing.

Dr. Frake has helped his clients throughout the product and technology development lifecycle, including early-stage innovation and concept generation, concept assessment, market research, technology landscaping, proof of principle testing, mathematical modelling, algorithms, data analysis, and prototype development. He has worked across many industries, including medical devices, pharmaceutical, oil & gas, mining, electric vehicles, consumer devices, industrial and the food & drink industry. His specific engineering experience includes battery tecnologies and systems, novel sensors and detection systems, measurement and metrology devices, temperature control / cryogenic systems, wireless power, acoustics, optics and general electromagnetics.

Dr. Frake's PhD was in the electrical measurement of quantum semiconductor devices at high frequencies. This had applications in quantum computation, novel electronic density of states measurements, charge pumping, and primary thermometry. During his PhD, he developed skills in semiconductor fabrication, semiconductor device analysis and testing, optical and e-beam lithography, SEM and AFM techniques, precision electrical measurements and RF electronics. Dr. Frake also has experience with cryogenic systems including Helium 3 and dilution refrigerators, superconducting magnets, and high vacuum systems. Before joining Exponent, Dr. Frake worked as a consultant at Sagentia Ltd., a science, technology and product development consultancy in Cambridge, UK.

Academic Credentials & Professional Honors

Ph.D., Physics, University of Cambridge, England, 2014

MPhys, Physics, University of Leeds, UK, 2008

Bragg Scholar

Prior Experience

Consultant – Sagentia Ltd, 2013-2019

Professional Affiliations

Instutue of Phyiscs – Member and Chartered Physicist (MPhys, CPhys)

Safety and Reliability Society – Fellow (FSaRS)

Chairman of BSI Standards Committee PEL/69/1 Small Electric modes of Transport

IEC/TC 125 “e-Transporters” UK nominated expert committee member

BSI standards committee member for the following:

• ESL/120 Electrical Energy Storage

• GME/33 “Small Craft”

• PEL/21 “Secondary Cells and Batteries”

• PEL/69 “Electric Vehicles”

• CH/210/1 “Quality management systems for medical devices”

• CH/210/4 “Risk management and post market surveillance for medical devices”

CEN/TC 301/WG 18 “Electric vehicles batteries” standards technical working group member.

Patents

US US11717447B2: Sensor enabled wound monitoring and therapy apparatus, 2017

US 20220160051: Aerosol-generating device and system with residue detector, 2019 – Pending

AU2020376971B2: A sensing array, system and method for ore processing equipment, 2020

US 20220125110: Aerosol-generating device having capacitance-based power control, 2019 - Pending

Publications

Nature Scientific Reports 5, Article number: 10858 (2015) – “Radio-frequency capacitance spectroscopy of metallic nanoparticles”, James C. Frake, Shinya Kano, Chiara Ciccarelli, Jonathan Griffiths, Masanori Sakamoto, Toshiharu Teranishi, Yutaka Majima, Charles G. Smith & Mark R. Buitelaar

Applied Physics Letters 100, 143104 (2012) – “Quantized Charge Pumping Through a Carbon Nanotube Double Quantum Dot”, S. J. Chorley, J. Frake, C. G. Smith, G. A. C. Jones, and M. R. Buitelaar.

Physical Review Letters 108, 036802 (2012) – “Measuring the Complex Admittance of a Carbon Nanotube Double Quantum Dot”, S. J. Chorley, J. Wabnig, Z. V. Penfold-Fitch, K. D. Petersson, J. Frake, C. G. Smith, and M. R. Buitelaar

ECS Advances 3, 010501 (2024) - “Evaluation of Fire Spread and Suppression Techniques in Micro-Mobility Battery Packs”. Daniel A. Torelli, Nicholas Faenza, Phil Johns, Sam Lawton and James Frake.

Presentations

European Crisis Management Summit 2022, Hanbury Manor, Ware, UK – “General Session: Lithium-ion Batteries”.

International Consumer Product Health and Safety Organization (ICPHSO) International Symposium Oct 2023, Almhult, Sweden, October 2023 – “Battling Lithium-Ion Battery Fires: Uniting for a Safer Future”

Electrical Product Safety Conference, Church House, Westminster, Nov 2023 – “On the market – product safety, supply chain and replaceability”.

International Consumer Product Health and Safety Organization (ICPHSO) Annual Meeting and Training Symposium, Florida, USA, February 2024 – “Battling Lithium-Ion Battery Fires”.

Poster Presentation “Evaluation of Fire Spread and Suppression Techniques in Micro-Mobility Battery Packs”, Faraday Conference, September 2024

International Consumer Product Health and Safety Organization (ICPHSO) International Symposium Oct 2024, EU Commission, Brussels, October 2024 – “Product Safety in an AI Era”

Project Experience

- Conducted hundreds of failure analysis investigations relating to batteries and battery powered products, ranging in size from consumer electronics to EVs and grid scale battery storage facilities.
- Audited global businesses to identify any potential shortcomings in manufacturing or general quality processes. This includes audits of batter cell, electric vehicle and micromobility product manufacturers to assess manufacturing quality and capability.
- Tested and evaluated battery cells, packs and products to assess functionality, performance and quality for multiple applications.
- Provided technical support to business with potential product recall situations relating to concerns around physical device safety, including recalls in the battery and micromobility space.
- Supported companies in product research, design, development, testing and evaluation in consumer, medical device, automotive and industrial sectors.

Technical Expertise

Some examples of work areas Dr. Frake has been involved in are:

- Assisting companies with compliance for medical device regulations in Europe, including the IVDR / MDR regulatory framework. This support has ranged from high level strategy and regulatory planning to remediation support and detailed engineering assessment / inspections of devices to check for compliance.
- Supporting clients in risk assessments and risk management processes across the product lifecycle - from the early stage R&D input, through to post-incident risk assessment to estimate end user risks.
- Battery failure analysis, design reviews and safety assessments for consumer, vehicular and industrial products.
- Conducting manufacturing and production audits for due diligence, regulatory compliance and engineering support in multiple sectors including batteries, medical devices, food and automotive sectors.

- Safety assessments, risk and crisis management for clients with regards to electric vehicles, toys, food packaging and batteries.
- Building customized sensors and measurement equipment in many industries, including medical devices, consumer devices, food and beverage, and industrial processing.
- Developing measurement systems and algorithms for condition and usage monitoring in applications such as medical drug delivery systems, patient compliance monitoring, air conditioning systems, industrial pumping equipment and power tools.
- Research and development of dermal biosensors and bio-impedance devices for medical and consumer applications.
- Research and development of electro-spraying, electro-spinning, and novel fluid atomisation technologies for consumer devices, medical devices and industrial manufacturing processes.
- Modeling and testing electric power cables for remote fault detection systems.
- Research and development of wireless power systems for application in medical, industrial and consumer sectors.
- Technology scouting and evaluation exercises in many fields, including medical devices, position sensors, and downhole sensing technologies for the oil and gas industry.
- Freedom to operate and patent landscaping studies, technology assessments and due diligence of startup companies for venture capital investments.
- Development of novel air / liquid cooling systems and gas dissolution technologies and systems.