PhD Advert Template

Project title: Integrating 2D Materials into 1D Systems for Wearable Applications

Project ID *(optional)*:

Accept all year-round applications

Funding information: Self-funded students only

Project description:

The ever-evolving advances in nanoscale materials has led to the development of a family of atomically thin materials (*i.e.*, 2D materials) that offer unprecedented electrical, electronic, and electrochemical properties. Notably, a recently discovered class of 2D materials called “MXenes” has shown an excellent electrical conductivity and exceptional ability to store energy while being processible in solution – unlike common conducting materials like metals.[1] This unique combination of properties has opened doors to the development of novel 1D systems (*i.e.*, fibres and yarns) that could be integrated into everyday clothes to enable new functionalities such as harvesting energy from the wearer’s movements or tracking the physical and physiological activities of the wearer.[2-6] The estimated surge in the global market for wearable gadgets from US$37.1 billion in 2020 to US$104.4 billion by 2027 indicates an apparent market opportunity for new types of wearable systems that offer novel functionalities.[7]

This project aims to develop innovative solution-based processing approaches to effectively integrate 2D materials like MXenes into highly functional 1D systems with comparable mechanical properties and wearability to conventional clothing fibres. When seamlessly integrated into textiles, novel smart garments could be achieved which could be worn like everyday clothes while offering some of the functionalities of the current wearable electronic gadgets (*e.g.*, heart rate monitoring and activity tracking), leading to a major step change in wearable electronics.

During your PhD journey, you will work with a wide range of 2D materials including MXenes and gain practical skills that will enable you to drive forward innovation in designing the next-generation wearable electronic systems using the 21st century materials. You will join a close-knit research team of [Digital Materials Manufacturing](http://www.digim2.com) at Newcastle University (UK) and will be guided throughout your project.

If you are passionate about making new discoveries in the field of 2D materials to shape the future of wearable electronics, we invite you to apply for this exciting PhD programme. Please contact Dr Shayan Seyedin by email ([shayan.seyedin@newcastle.ac.uk](mailto:shayan.seyedin@newcastle.ac.uk)) if you wish to discuss the project and the application process.

*Newcastle University is committed to being a fully inclusive Global University which actively recruits, supports and retains colleagues from all sectors of society. We value diversity as well as celebrate, support and thrive on the contributions of all our employees and the communities they represent. We are proud to be an equal opportunities employer and encourage applications from everybody, regardless of race, sex, ethnicity, religion, nationality, sexual orientation, age, disability, gender identity, marital status/civil partnership, pregnancy and maternity, as well as being open to flexible working practices.*

References:

[1] *Adv. Mater.* 32, 2001093, 2020.

[2] *Adv. Funct. Mater.* 30, 1910504, 2020.

[3] *ACS Cent. Sci.* 6, 254, 2020.

[4] *Adv. Funct. Mater.* 29, 1905015, 2019.

[5] *Small* 14, 1802225, 2018.

[6] *J. Mater. Chem. A* 5, 24076, 2017.

[7] Wearable Technology, *Grand View Research*, 2020.

Application enquires:

[Dr Shayan Seyedin, Senior Lecturer in Chemical Engineering](mailto:shayan.seyedin@newcastle.ac.uk)

<https://www.ncl.ac.uk/engineering/staff/profile/shayanseyedin.html>

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landscape architecture

rural planning

surveying

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biochemistry

biodiversity

bioinformatics

biophysics

biotechnology

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cell biology

developmental biology

ecology

ecotoxicology

entomology

environmental biology

evolution

genetic engineering

genetics

genomics

human genetics

immunology

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molecular biology

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synthetic chemistry

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broadcast media

digital media

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print media

production

public relations

publishing

other

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computer vision

computer graphics

cyber security

data science

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internet of things

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networks

quantum computing

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art

crafts

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design

drama

fashion

film studies

fine art

graphic design

interior design

music

music technology

photography

theatre studies

other

Economics

econometrics

financial economics

macroeconomics

microeconomics

political economics

other

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further education

higher education

nursery education

primary education

secondary education

special needs education

other

Engineering

acoustics engineering

aerospace engineering

atomic engineering

automotive engineering

bioengineering

biomedical engineering

chemical engineering

civil engineering

communications engineering

control systems

cybernetics

dynamics

electrical engineering

electronic engineering

energy technologies

environmental engineering

fluid mechanics

gas engineering

geotechnical engineering

integrated engineering

manufacturing engineering

marine engineering

mechanical engineering

mechanics

mechatronics

nanotechnology

offshore engineering

petroleum engineering

robotics

solid mechanics

structural engineering

structural mechanics

systems engineering

thermodynamics

other

Environmental Sciences

climate science

hydrology

marine sciences

meteorology

pollution

soil science

other

Finance

actuarial science

banking

financial management

insurance

investment

taxation

other

Food Sciences

food hygiene

food production

other

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archaeological science

forensic science

other

Geography

agricultural geography

cultural geography

economic geography

environmental geography

geographical information systems gis

historical geography

human geography

marine geography

physical geography

political geography

remote sensing

social geography

transport geography

urban geography

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applied geology

geochemistry

geophysics

geoscience

geotechnology

hydrogeology

marine geology

palaeontology

seismology

volcanology

other

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american history

ancient history

archaeology

asian history

australasian history

british and irish history

economic history

european history

heritage studies

history

history of art

history of religions

history of science

medieval history

military history

modern history

russian history

social history

world history

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information systems

librarianship

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Languages, Literature & Culture

african studies

american studies

asian studies

australasian studies

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danish

dutch

english language

english literature

european studies

finnish

french

german

italian

japanese

middle eastern studies

norwegian

portuguese

russian

spanish

swedish

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Law

criminal law

commercial law

contract law

property law

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Linguistics & Classics

ancient greek

celtic studies

classics

latin

linguistics

other

Materials Science

ceramics

glass

metallurgy

polymers

textiles

other

Mathematics

applied mathematics

applied statistics

computational mathematics

data analysis

engineering mathematics

mathematical modelling

medical statistics

operational research

probability

pure mathematics

statistics

stochastic processes

other

Medicine

anatomy

audiology

biomechanics

cardiology

complementary medicine

dentistry

endocrinology

epidemiology

neural engineering

neurology

nutrition

ophthalmology

optometry

pathology

pharmacology

pharmacy

physiology

physiotherapy

podiatry

radiology

speech science

tissue engineering

toxicology

other

Nursing & Health

adult nursing

community nursing

counselling

dental nursing

environmental health

health informatics

medical nursing

mental health nursing

midwifery

occupational health

occupational therapy

paediatric nursing

paramedical science

surgical nursing

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metaphysics

philosophy of science

other

Physics

acoustics

astronomy

astrophysics

chemical physics

computational physics

electromagnetism

environmental physics

experimental physics

medical physics

nuclear physics

optical physics

particle physics

quantum mechanics

solid state physics

space science

theoretical physics

other

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development studies

government

international relations

politics

public policy

other

Psychology

child psychology

clinical psychology

community psychology

counselling psychology

developmental psychology

educational psychology

forensic psychology

health psychology

neuropsychology

occupational psychology

organisational psychology

psychotherapy

sport psychology

other

Sociology

criminology

disability studies

gender studies

socio economics

social work

other

Sport & Exercise Science

sport coaching

sport development

sport performance

sport technology

sport therapy

other

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divinity

religious studies

theology

other

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animal welfare

veterinary dentistry

veterinary medicine

veterinary nursing

veterinary nutrition

veterinary pathology

other