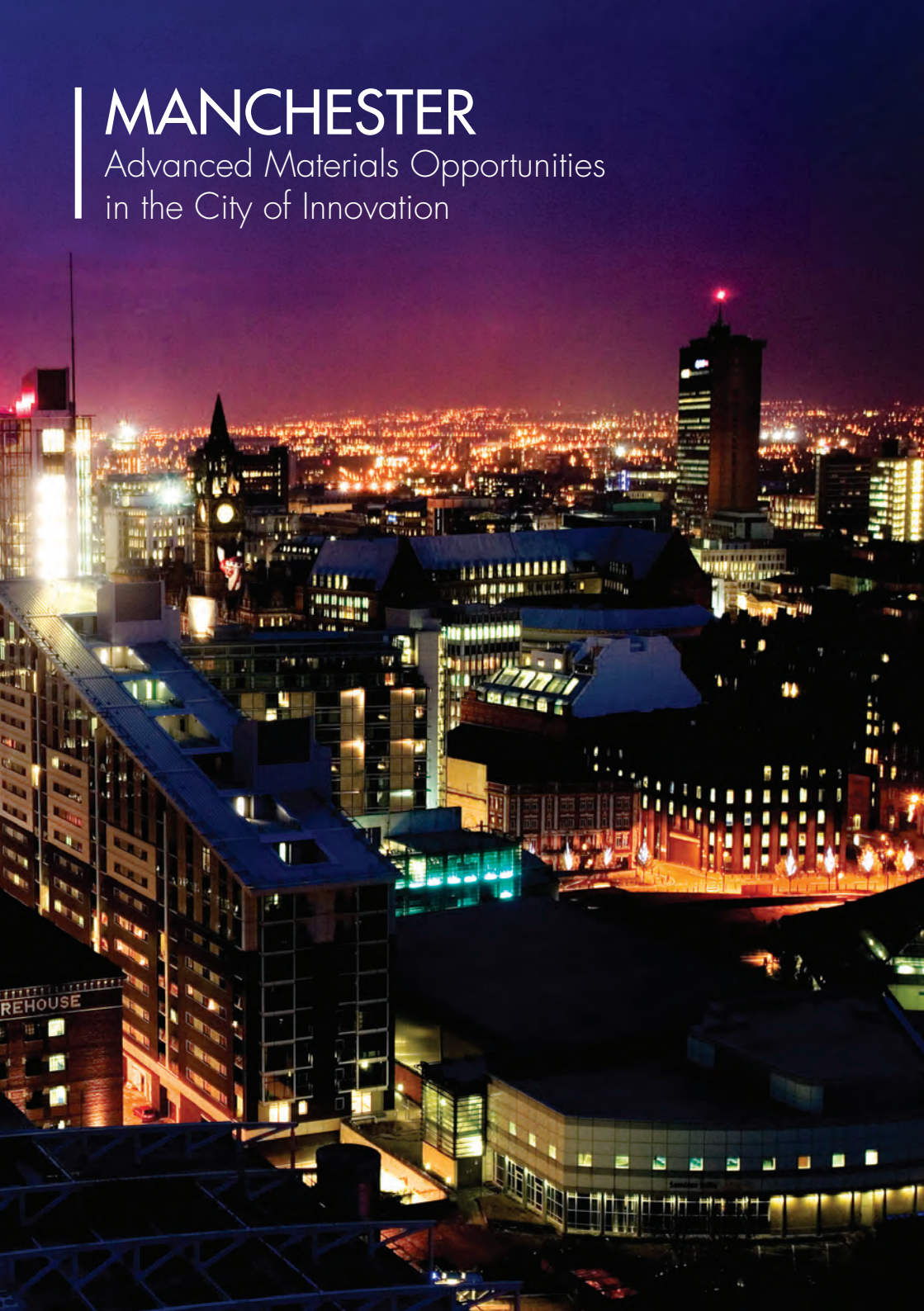
MANCHESTER

Advanced Materials Opportunities in the City of Innovation



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"Best UK City to Live"
Economist Intelligence Unit, 2013

"Fastest Growing Economy Outside of London "
Grant Thornton, High Growth Index, 2014

"Number One City in the UK to Locate a Headquarters"
Cushman and Wakefield, 2013

WELCOME

Advanced materials opportunities in the city of innovation – a definitive guide to Manchester's advanced materials sector

Manchester innovates. It always has. Manchester was the world's first industrial city with the first factories and the first industrial estate. Manchester is a city of pioneering engineers, attracting curious and ambitious business minds.

This is where Henry Rolls met Charles Royce; it's where Henry Ford built his first European cars, where Tom Williams and FC Kilburn built the world's first modern computer and where the city's latest Nobel Prize winners isolated the world's thinnest and most conductive material, graphene.

Today, the biggest brands and the brightest minds of tomorrow are researching and making materials in Manchester so advanced for applications that we are yet to imagine.

As the UK's second largest economy, Manchester is an important economic engine driving the country's growth and prosperity. Manchester has identified advanced materials as one of the key areas to continue to drive this growth.

Advanced materials can be classed as any material that offers an advantage over a traditional alternative. It may be a completely new material such as graphene, an existing material that has been improved, two or more existing materials that are combined to create a new improved material system like an advanced composite, or it may be a new way of using existing materials.

The scale of the market opportunity for advanced materials in Manchester is limitless. Thousands of leading companies choose to base their research, design, development and manufacturing here.

Supply-chains are vital to manufacturers and the region's extensive road, rail, sea and air connections put businesses closer to their customers, suppliers and new opportunities.

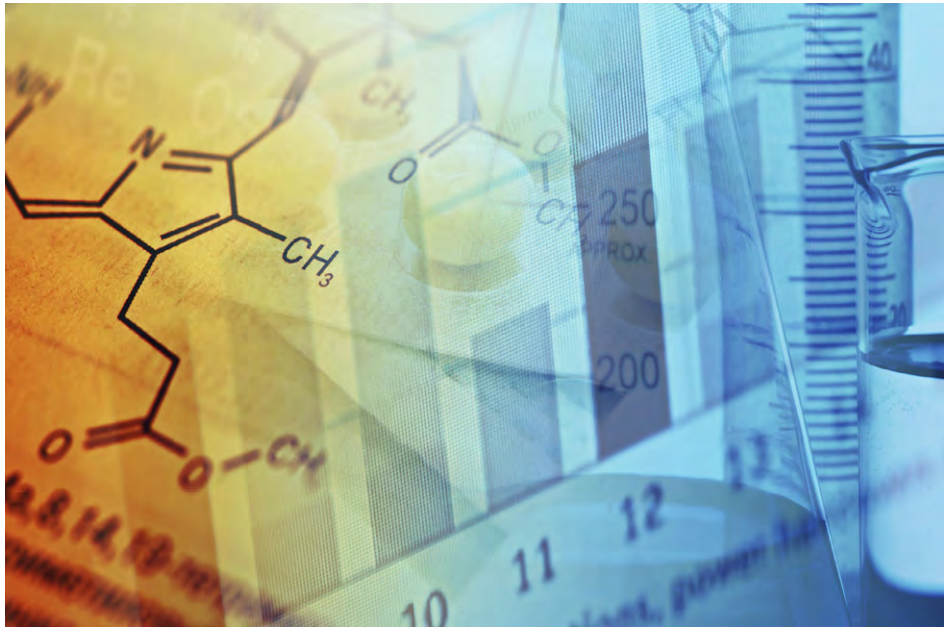
Global export markets are in easy reach too, thanks to Manchester Airport which serves over 200 global destinations and is home to the World Freight Terminal handling daily cargo shipments world-wide.

As a leading centre for advanced materials, Manchester has the right ingredients to energise your business. It provides unparalleled access to significant market opportunities, a strong and established skills base, an impressive range of cutting-edge research and world-class educational facilities.

You don't need a Nobel Prize to choose Manchester, but if you're looking for somewhere that can unlock a world of possibilities and where the future is being made today – Manchester is the place for you.

"THIS IS THE PLACE THAT SPLIT THE ATOM, BUILT THE WORLD'S FIRST COMPUTER AND ISOLATED GRAPHENE. WE WANT INNOVATIVE BUSINESSES TO COLLOBORATE WITH OUR WORLD-CLASS UNIVERSITIES AND HELP GENERATE THE NEXT SET OF FIRSTS."

Sir Howard Bernstein, Chief Executive of Manchester City Council



WHY MANCHESTER

Expertise

Manchester's capability in developing, making and using advanced materials is world-class. We have particular strengths in the making and characterisation of:

- Graphene & 2D materials
- Light alloys
- Surfaces and coatings
- Composites
- Technical textiles.

Additional strengths include application and use in major industries, including aerospace and automotive, nuclear, oil and gas, health, and electronics.

Talent

Over 116,000 people are employed in manufacturing from Manchester's working population of 1.3 million.

The region also has the largest travel to work area of any UK city outside London with a workforce of 7.2 million people living within a one hour commute of the city.

The city's four universities have over 106,000 students, of which 14,000 are studying disciplines relevant to advanced materials. Manchester punches above its weight and is home to 27% of the UK's materials science students, 34% of metallurgy students and 59% of the country's polymers and textiles students.

World-class R&D

Home to the largest materials science research base in Europe, with first-class characterisation expertise, a growing portfolio of other technical facilities and equipment for shared use.
The region hosts internationally renowned research centres, supported by leading industrial partners such as the National Graphene Institute (NGI), Aerospace Research Institute, North West Composites Centre, National Composites Certification & Evaluation Facility, BP International Centre for Advanced Materials and Dalton Research Institute.

Innovation

Manchester is a city of firsts; from the birthplace of the industrial revolution, the splitting of the atom, the first stored program computer, to the first test tube baby and most recently, the isolation of graphene, the world's thinnest and strongest material.

Manchester has a strong track record of facilitating innovation, both nationally and internationally and can provide businesses with access to a varied mix of discovery, real-world testing, and characterisation, evaluation and certification.

Supportive ecosystem

Manchester is investing millions in state-of-the-art facilities and collaborative environments which form the foundations of a strong supportive and innovative environment in which to invest.

Open innovation networking and appropriate IP protection lie at the heart of our ethos, reaching out to clusters of expertise elsewhere in the UK and internationally. Manchester is home to the UK's only Airport City, which is part of an Enterprise Zone that adjoins Manchester Airport, enabling easy global communications.

Investable

New and improved high performance materials have been identified as crucial for Manchester and the UK's economy and future.

The Government and Innovate UK recognise advanced materials as one of the eight great technologies with the potential to revolutionise industrial and economic performance.

Manchester, as a world leader in the development and use of advanced materials, provides the perfect location to capitalise on these opportunities.

7.2M Workforce within commuting distance of the city

106,000 University students in Manchester

£121M Invested in the NGI & Graphene Engineering Innovation Centre in Manchester

Key companies operating in advanced materials in Manchester and the wider North West

AIRBUS
BAE SYSTEMS
BASF The Chemical Company
Bentley
BGT Bluestone Global Tech
bp
FibrLec University of Bolton
GlaxoSmithKline
innovia Films
Magnesium Elektron Service & Innovation in Magnesium
NANOCO Group PLC
Pilkington
NXP
PZ Cussons
Rolls-Royce
sigmatex material innovation
SUMED
SunChemical
Unilever
Vauxhall
victrex

MARKET OPPORTUNITIES

As Europe's largest materials science research centre, Manchester provides a natural base for any business wishing to exploit the significant opportunities presented by both the UK and global markets.

The UK recognises advanced materials as one of the eight great technologies with the potential to revolutionise industrial and economic performance. It is one of four enabling technologies seen as key to innovation and meeting the global challenges around energy, food security, healthcare, transport, high performance computing and the built environment.

The UK government policy is focused on developing the knowledge economy to ensure the continued future growth and prosperity and therefore advanced materials has a high priority in the UK.

Global opportunities

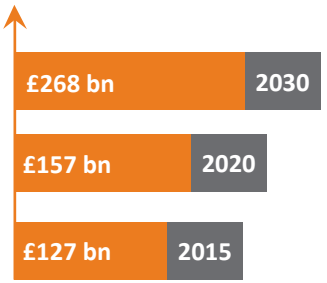
£13.6 TRILLION

estimated global worth of the main industry sectors that use advanced materials (energy, transport, environment, health and ICT)

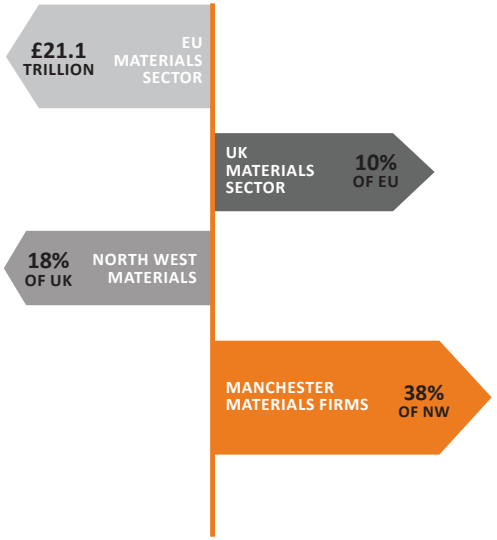
£2.5 TRILLION

estimated worth of the proportion within the industry sectors relevant for advanced materials

Global demand for advanced materials



Materials production in context



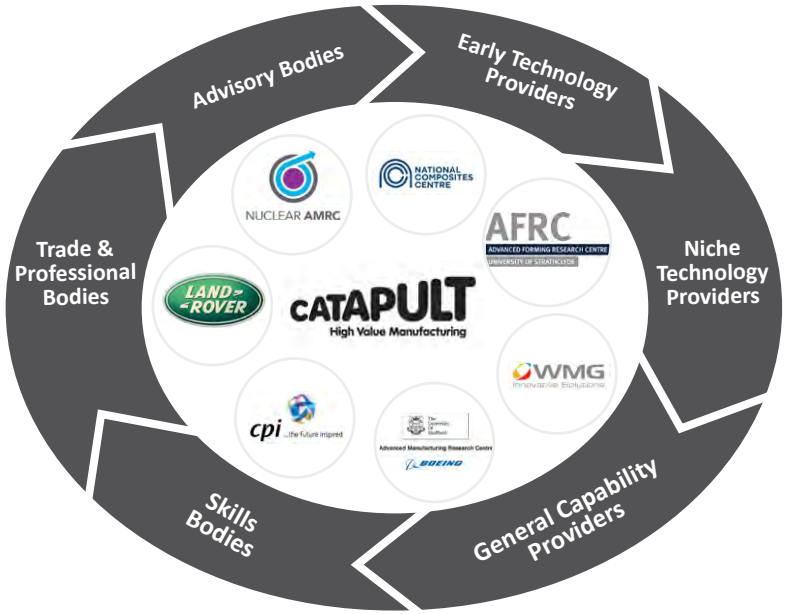
Advanced materials are significantly represented in the North West of England – as shown above. Businesses located in Manchester and the North West's materials sector have a combined turnover of £33 billion and contribute £9 billion of GVA. This amounts to 18% of the UK GVA in the sector, which is almost twice the share of the total GVA generated in the NW (10%).

THE CITY'S PIONEERING WORK ON GRAPHENE COULD CHANGE THE WORLD AS RADICALLY AS THE INDUSTRIAL REVOLUTION DID AND WE'RE PROUD TO SAY THAT BOTH EVENTS WERE AND WILL BE SHAPED IN MANCHESTER.

A SUPPORTIVE ENVIRONMENT

The UK offers a very supportive environment for the development of advanced materials. Through Innovate UK, the Government has invested over £1 billion to establish seven Catapult Centres, a network of technology and innovation centres.

The High Value Manufacturing Catapult alone received over £200 million of funding across a number of centres aimed at working with businesses, scientists and engineers to transform early innovation into products.



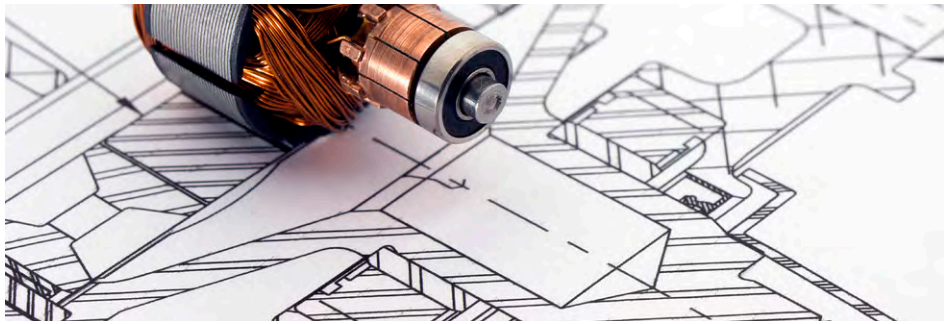
The right business environment

Partnerships are an important part of Manchester and many organisations have worked together to create a shared vision for the city. Strong links between the public, private sector and academia exist to deliver innovative solutions and create a supportive business environment. A range of alliances exist which encourage supply chain collaboration in key sectors. For example, the North West Automotive Alliance and North West Aerospace Alliance support their respective sectors. NWtexnet supports research and development and provides training in textiles.

Manchester is at the heart of a range of clusters and corridors of expertise relevant to advanced materials.

ESTABLISHED
SKILLS AND EXPERTISE

Manchester offers direct access to one of the UK's most established and diverse manufacturing and engineering skill base.



Over 116,000 people are employed in manufacturing from Manchester's working population of 1.3 million.

The region also has the largest travel to work area of any UK city outside London with a workforce of 7.2 million people living within a one hour commute of the city. Manchester and the North West's world-class science, commercialisation and manufacturing has attracted some of the world's leading firms including **Airbus, BAE Systems, BASF, Bluestone Global Tech, Fibrlec, Magnesium Elektron, NXP, Nanoco, PZ Cussons, Rolls Royce, SunChemical, Sigmatex, Sumed, Siemens** and **Unilever.**

Unrivalled talent pool

Home to world-class universities and research capabilities for advanced materials, Manchester offers unparalleled access to knowledge transfer, cutting-edge research facilities, collaborative working and a skilled and talented graduate base. Manchester is home to one of Europe's largest student populations with 106,000 students studying at its four universities, of which 16,000 are international.

Business located here can access the talent pipeline of the 14,000 students studying disciplines relevant to advanced materials at Manchester's universities. Manchester has a large share of the UK's advanced materials students studying at the region's four universities.

27% **of UK materials science students**

34% **of metallurgy students**

59% **of UK polymers and textiles students**

MANCHESTER EUROPEAN CITY OF SCIENCE

City of Innovation

Manchester is the city where the atom was split, where the first programmable computer was developed and where graphene was first isolated. The city has a heritage of innovation and it has been awarded the accolade of **Europe's 'City of Science'** for 2016, as a reflection of its commitment to scientific education and research.

This prestigious status will attract some of the world's leading scientists and innovators to Manchester in 2016 and beyond.

WORLD-CLASS
RESEARCH EXPERTISE

MANCHESTER 1824
The University of Manchester

The largest school of materials in Europe hosts a range of leading institutes including:

National Graphene Institute

The University has invested in a £61 million facility, which will be the world's leading centre for graphene research and commercialisation, housing state-of-the-art facilities for use by universities and businesses from around the world.

BP International Centre for Advanced Materials

A 10 year £64 million research collaboration with **BP** and three other universities where Manchester is the hub. The aim is to stimulate the sector with fundamental research through to application and to lever in other funding. Around 30-40% of activity is focused around corrosion.

North West Composites Centre

Part of a network of five centres across the UK working to bridge the gap between pure academic research and industry by qualifying materials and parts, developing new technologies, supporting the supply chain and training composites engineers.

Graphene Engineering Innovation Centre (GEIC)

Due to open in 2017, the £60m GEIC will be critical in the development of commercial applications with graphene and related 2D materials. Located at the University of Manchester. It will enable graphene products to be fast-tracked from initial concept to the market.

The University of Manchester's Dalton Nuclear Institute

The most advanced academic nuclear research capability in the UK and an internationally recognised centre of excellence with a track record of collaborating with industry and driving innovation across the nuclear fuel cycle.

National Composites Certification and Evaluation Facility

The commercial arm of the North West Composites Centre.

Aerospace Research Institute

Multi-disciplinary industry research centre comprising over 100 academics from across the University of Manchester.

University of Bolton

University of Salford MANCHESTER

Manchester Metropolitan University

The Institute of Materials Research and Innovation

World leading in advanced textiles.

Materials & Physics Research Centre

Ranked 8th in the UK by Research Fortnight and top 5 for industry engagement by the Witty Review (2013).

Dalton Research Institute

The Institute focuses on materials science covering surface engineering, characterisation of surface coatings and organic polymers including fire retardants.

WORLD-CLASS CAPABILITIES

Manchester's engineering and manufacturing expertise is well known, and is a huge bonus for companies looking to invest or relocate to the city. These skills are being used to help develop a new generation of advanced materials.

Manchester's key strengths

Manchester has world-class capabilities in advanced materials in terms of discovery, characterisation and manufacturing. There are significant opportunities for research funding, commercial investment, prototyping, testing and manufacturing activities in these areas:

- Graphene and other 2D materials
- Surfaces and coatings
- Light alloys
- Composites
- Technical textiles

Science commercialisation and manufacturing

Manchester is world-renowned for discovering new materials like graphene, as well as advanced textiles, surfaces and coatings. The region is particularly strong in characterising materials in terms of their hygrothermal, electrical and mechanical properties and application for different end uses. This supports manufacturers in quality assuring their materials and end users in assessing lifespan, failure likelihood and tolerances.

Manchester, and the wider region, has a proven track-record in manufacturing. It is one of the UK's and EU's principal manufacturing regions. It is this combination of discovery, characterisation, testing and accreditation of new and improved advanced materials, coupled with the North West's major manufacturing strengths that make Manchester the ideal environment for investing in advanced materials.

Key

World Class Capability

Key Strength or Developing Area

Manchester's strengths in the application of advanced materials in different sectors

USING

AEROSPACE

- Graphene
- Surfaces & coatings
- Light alloys
- Technical textiles
- Composites

OIL & GAS

- Graphene
- Surfaces & coatings
- Technical textiles
- Composites

NUCLEAR

- Graphene
- Surfaces & coatings
- Light alloys
- Technical textiles

BIO-MEDICAL

- Graphene
- Surfaces & coatings
- Light alloys
- Technical textiles

ELECTRONICS

- Graphene
- Surfaces & coatings

AUTOMOTIVE

- Graphene
- Surfaces & coatings
- Light alloys
- Technical textiles
- Composites

Key

World Class Capability

Key Strength or Developing Area

INVESTMENT OPPORTUNITIES

Manchester offers a wealth of opportunities in advanced materials, which include:

GRAPHENE/2D MATERIALS

Opportunities

Bulk graphene production/Developing electronics applications

There are opportunities to invest in graphene manufacturing, drawing upon the existing manufacturing expertise and characterisation capabilities. As the home of the National Graphene Institute and the Graphene Engineering Innovation Centre Manchester offers businesses the opportunity to work in collaboration and develop applications, with electronics being the most advanced; plus there are opportunities to exploit the potential of other new 2D materials.

LIGHT ALLOYS

Opportunities

Manufacturing with new alloys/Developing biomedical applications

Manchester's strengths are in characterising alloys so that new uses can emerge, the most recent being within biomedical applications. Key capabilities are in aluminium, titanium, zirconium and magnesium. In particular, Manchester is a world leader in the development of magnesium alloys for use in light weight applications such as aerospace.

SURFACES & COATINGS

Opportunities

New surfaces/Quantum dot applications (lighting)/Anti-corrosion surfaces

The region's strengths in corrosion are world-leading as are its capabilities in manufacturing quantum dots with applications for lighting and electronics. Manchester's expertise in the testing of inks e.g. on packaging, inkjet printing of electronic circuits and in surfaces for harsh environments to prevent corrosion and degradation, provide opportunities for businesses looking to grow in this area.

COMPOSITES

Opportunities

Ultralight weight and 3D weaving of complex shapes/Extend automotive use especially Tier1 suppliers

There is a growing opportunity and capability in ultralight weight technologies 3D composites and in extending their use in the automotive industry and Manchester offers businesses the opportunity to take advantage of composites.

TECHNICAL TEXTILES

Opportunities

Chitocel wound dressings/Carbon fibre raw material production.

There is a gap in the UK supply chain for carbon fibre production which is all imported. Carbon fibre (CF) demand is forecast to grow rapidly; BMW has recently purchased a CF producer to secure supplies for its new i-series. Manchester has strong capabilities in quality assurance and characterisation of CF. Opportunities exist in the development of new CF production techniques which are less energy intensive and focus on the high quality end of the market. Manchester provides an ideal location for establishing a UK CF plant. There are also specific opportunities to invest in manufacturing new, but proven, advanced textiles such as Chitocel – a revolutionary ultra-absorbent wound dressing.

The National Graphene Institute

ABOUT MIDAS

MIDAS, Manchester's inward investment agency, can help you and your business with relocation and expansion plans. MIDAS has a reputation for understanding diverse business needs and helping to remove any barriers for companies looking to locate or expand into Manchester.

Their specialist business development team can assist you with a range of free, bespoke packages of confidential support that will make your journey as smooth and simple as possible.

The services provided by the team, which are also available to intermediaries such as location consultants, will save you money, time and effort and will enhance your project with the expert knowledge and local intelligence that result in a faster and more successful move.

MIDAS Services
Free support includes:

- Research support and business case development
- Introductions to local networks
- Recruitment and training support and advice
- Property solutions
- Relocation advice and assistance
- Post-investment PR support

See how MIDAS can help you make Manchester part of your success story.

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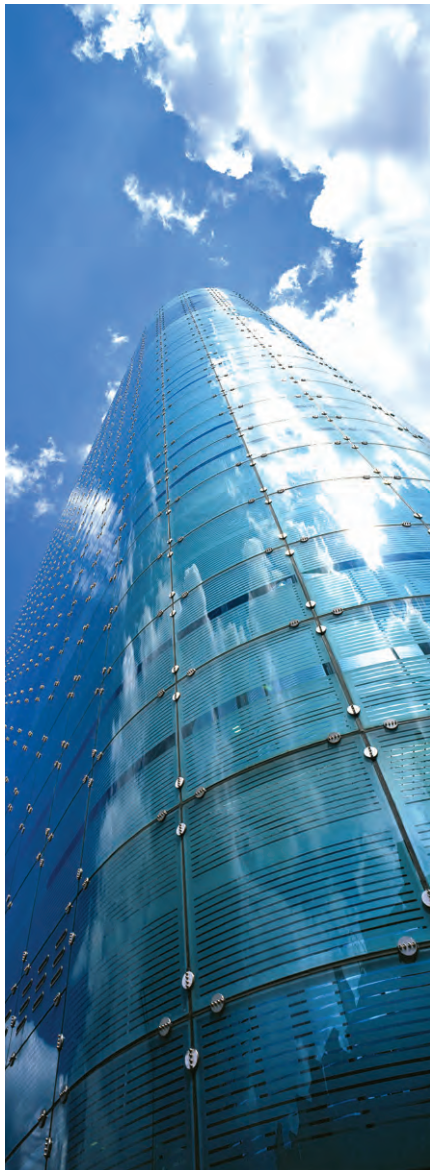

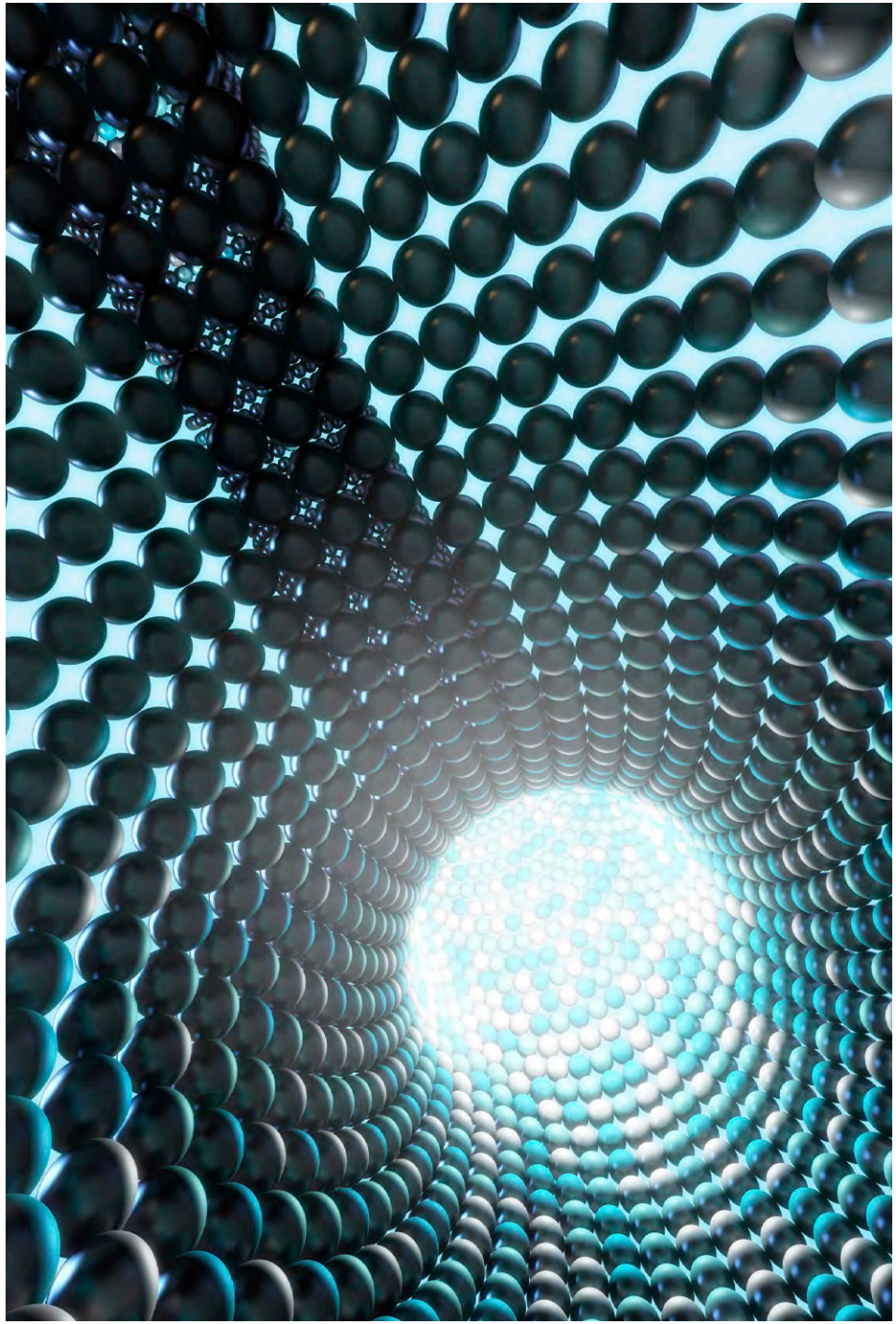

“Most Competitive Business Location in Europe”

KPMG Competitive Alternatives, 2014

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