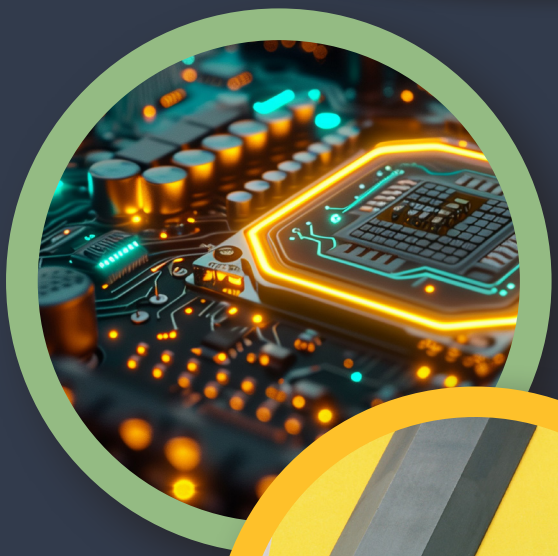
MICG Midlands Industrial Ceramics Group



ADVANCED CERAMICS SECTOR

Priorities for Action

2026

INTRODUCTION

This Priorities paper provides a summary of the opportunities and challenges for the Advanced Ceramics sector in the Midlands. It sets out key areas of action, as agreed by the MICG partners, that they will tackle collaboratively.

In July 2021, the Midlands Industrial Ceramics Group (MICG) secured **£18.3 million** of UK Research and Innovation's (UKRI's) Strength In Places Funding to strengthen the area as a global centre for Advanced Ceramics.

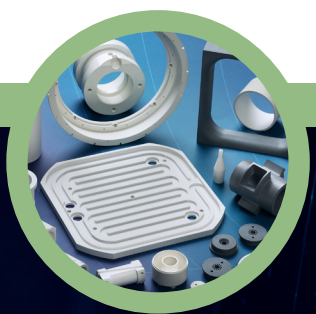
With other investment, the five-year industrial and academic research programme will be worth **£42.1 million on completion in 2026.** It has six technical workstreams and a further four supporting workstreams. More details can be found on our website, under the Projects tab. Whilst having achieved significant advancements during this period the partnership recognises there is much more to do, and that working together is a more efficient way of tackling common challenges. This paper sets out what are the next key priority areas for the partnership.

This paper briefly describes the uses of Advanced Ceramic Materials, summarises the sector in the Midlands, highlights its challenges and opportunities, and sets out the key areas of action that should be addressed to strengthen and grow the competitiveness of the sector within the Midlands.

It is informed by the 'Advance Ceramics in the Midlands – Baseline Report', produced by SQW in January 2023 and primary research completed by the MICG partnership in June 2025. It is shaped by the MICG members, which represents Midlands advanced ceramics producers, its research base and end users.

This document has been adopted by the MICG partnership. It will be the foundation that future partnership action plans are built upon. It will be used to communicate the priorities of the partnership to government, funders and other stakeholders.

If you wish to contribute towards the MICG's work, or benefit from involvement in the partnership, please do make contact through our website.



What are Advanced Ceramic materials?

Advanced ceramics are inorganic, non-metallic materials with high strength, low corrosion and excellent thermal and electrical properties.

They differ from traditional ceramics because they are made using high purity, refined materials such as alumina, zirconia and silicon carbide to deliver exceptional properties.

These are densified by transient-liquid or solid-state sintering and are used to improve performance of products in hi-tech sectors, including aerospace, energy, electronics, defence and healthcare.

Alumina is commonly used for electrical insulation, and for wear and chemical resistance in pump applications.

Zirconia is used for sensors in automotive and for valves in industrial applications. Silicon carbide has diverse uses from kiln furniture, to support structures for space applications.

Examples of uses by sector include:

DEFENCE	AEROSPACE	AUTOMOTIVE	ELECTRONIC	ENERGY
engine components, armour and sensor protection	thermal barrier coatings, composites for turbine blades	pump components, brake discs, spark plugs, sensors and fuel injection systems	transmitters, receivers and circuitry for sensors	heat pumps, photovoltaics, nuclear and energy storage

The Advanced Ceramics Sector

The Advanced Ceramics has annually grown at around **13%,** out-stripping growth in general manufacturing sectors. This is forecast to continue over the next decade. The global industry is expected to be worth **£143 billion by the end of 2025**. The UK has key competitive strengths in this sector and should target the sector as an opportunity for domestic growth.

The value of the UK Advanced Ceramics sector was estimated to be worth **£2.5 billion in 2024.** It has particular strengths in high-end consumer electronics and the aerospace and automotive sectors, but is expected to grow rapidly in areas such as defence and nuclear.

There are estimated to be around 77 'technical ceramics' companies in England*, nearly half (35) of which are located in the Midlands.

There is a particular concentration (19) in the Stoke-on-Trent and Staffordshire area. Midlands businesses provide 23% of the sector's employment in the UK.

Innovation and Knowledge in the Midlands

Collaboration between universities, research institutes and businesses is crucial to developing the Advanced Ceramics sector.

Key research assets within the region include:

LUCIDEON

Formally the British Ceramic Research Association, develops and tests advanced ceramics for commercial use. AMRICC, a subsidiary of Lucideon has become a global leader in flash sintering.

WARWICK MANUFACTURING GROUP

Is a High Value Manufacturing Catapult, based at the University of Warwick with capabilities in cold and flash sintering and ceramic materials analysis.

UNIVERSITY OF BIRMINGHAM

Has research specialisms in biomaterials, engineering ceramics, functional ceramics and electronic ceramics

UNIVERSITY OF LEICESTER

Has expertise in computer modelling, including developing twins for advanced ceramics manufacturing processes

LOUGHBOROUGH UNIVERSITY

Has specialisms in additive manufacturing, characterisation and field assisted sintering.

UNIVERSITY OF NOTTINGHAM

Has key strengths in ceramic processing techniques and their applications in diverse areas such as medicine, energy, and environmental sustainability.

LUCIDEON

The AMRICC Centre

MICG Midlands Industrial Ceramics Group

KEY CHALLENGES FOR THE SECTOR

The MICG was established in 2020 to help drive the competitiveness and success of the Midlands Advanced Ceramics sector. Members include key manufacturers, universities/ research institutes and end users. The MICG aims to drive technological breakthroughs, make the Midlands the go-to location for advanced ceramics R&D and manufacture, strengthen the supply chain and increase the competitiveness of the industrial base.

It has identified the following key challenges.

THE IMPORTNANCE OF THE SECTOR AND THE OPPORTUNITIES FOR IT NEED TO BE PROMOTED

Advanced ceramics are enabling technologies that are essential across many critical applications. However, they are often hidden and their importance not obvious to people not familiar with their properties and applications.

When people think of ceramics they also think of traditional industries creating tableware, vases and bathroom products etc. Less is know about the high-tech, knowledge intensive, rapidly growing industry that is advanced ceramics.

When end users are looking for new solutions, the technologists in charge of product development need to always have as strong an understanding of advanced ceramics versus other materials. This may lead to sub-optimal solutions being pursued and an opportunity missed for advanced ceramics producers.

The next generation of industrial scientists may not understand the opportunities available and the future growth of the sector, understanding career opportunities that would benefit them and the industry.

It is therefore critical that those working in the industry work hard to make it visible and understood by policy makers and funders, end users and the future workforce.

HIGH INNOVATION AND PRODUCTION COSTS

Ceramics by their nature are energy intensive to produce, and this is no different for advanced ceramics. The costs of energy for industrial production in the UK exceed that of its main international competitors and this is often cited as a drag on international competitiveness of firms in the industry (the UK remains competitive owing to other factors, such as the strength of its R&D sector, its workforce and the stable legislative environment). Anything that could help produce ceramics using less energy, and from readily available sources of energy would greatly help the sector.

Due to the high performance required from advanced ceramics the quality standard of components is very high relative to other sectors. This results in high levels of waste from failing products. Improvements in production techniques that lowers waste from failing products would help raise

competitiveness. This has been a focus of much of the early SIPF work by the MICG, but it is recognised much more is still required.

Due to the highly specialized nature of advanced ceramics the innovation of new products is often time consuming and complicated to establish optimum manufacturing processes. This results in new product development being time consuming and costly. The MICG have worked via digital modelling research, characterization techniques and the AMRICC pilot line facilities to improve the pace of innovation in advanced ceramics. The MICG expect to see benefits from this work, but it is clear further work is required to build on the SIPF legacy.

THE SECTOR NEEDS TO BECOME MORE EFFICIENT TO RESPOND TO THE CLIMATE CRISIS

The effect of energy intensive production using fossil fuels, and the high level of waste (both through failed products and residual materials created through production) means the footprint of the sector on the planet is significant. The MICG and its partners recognise improvements in this area could lead to both a lower carbon footprint but also lowering costs (creating a win-win for the planet and the Midlands competitiveness).

A key area of focus for the MICG is to undertake collaborative research that improves production techniques using new sources of fuel (e.g. hydrogen, flash sintering). Explore systems for recycled energy created from production and exploring how waste can be re-purposed and re-sued (ultimately lowering the waste that ends up in landfill).

DEPENDANCY ON OVERSEAS ADVANCED CERAMICS MATERIALS AND COMPONENTS

The UK is an open economy, where many components for manufacturing are imported and its products exported. Advanced Ceramics is no different with UK produced advanced ceramics being created using imported specialist materials, the end product being used domestically and exported. End-users in the UK will be sourcing the components they need both domestically but also importing.

The critical enabling nature of the advanced ceramics components means that the UK's defence, aerospace, energy and nuclear industries is dependent on overseas trading partners (providing either the materials required to produce domestically produced components or directly supplying the components themselves). This places the UK in a vulnerable position, exacerbated by the current geo-political environment (raised prospect of global conflict and trade-wars).

On-shoring the production of materials required for the advanced ceramics industry and the manufacturing of components that are vital UK national security is a necessity.

THE SECTOR NEEDS TO ATTRACT AND TRAIN THE NEXT GENERATION OF ADVANCED CERAMICISTS

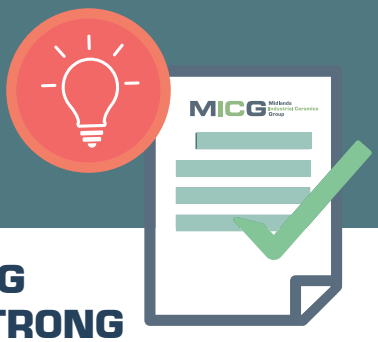
The sector has an ageing workforce and research suggests the next generation is not always aware of the vast opportunities the sector has to offer.

The sector is specialist and requires a different knowledge and skillset versus the traditional ceramics sector and other material based industries.

The lack of specific advanced ceramics education and training pathways within the region is suggested to limits the number of new entrants.

The MICG, and AMRICC in particular, has highlighted these challenges and have begun to develop curriculum and promotional materials to address this. The continuation of this work will be critical.

Key Areas of Action



GROWING THE PARTNERSHIP

The MICG was formed in 2020. At the outset it was exclusively for research organisations and companies based in the Midlands. The MICG Partnership recognise that the Midlands advanced ceramics base does not operate in a geography restricted to the Midlands. It will therefore be a goal of the partnership to:

- Expand the partnership to ensure any research organisation that can help the Midlands advanced ceramics sector can play its role (whether they are from from inside or outside the Midlands)
- Grow the quantity and breadth of industrial partners to ensure the partnership remains commercially focused and meets the diverse needs to of the industrial base

COLLABORATING TO PROMOTE THE SECTOR

MICG members can promote the sector with a stronger voice when speaking as one. This is expected to be a key function of the partnership and will include activities such as:

- Joining forces to represent the partnership and its members at domestic and international trade shows, raising the profile of the MICG members and the Midlands / UK
- Communicating jointly the needs of the sector to inform both national and local policy and industrial strategy
- Supporting local and national government to communicate local and UK competitiveness
- Promoting opportunities in the sector to new companies, workers and end users
- Promoting the Midlands as a great place to work and invest

COLLABROATING TO ENSURE A STRONG INNOVATION ECOSYTEM

The MICG has an impressive track record for collaborative research through the SIPF programme and the establishment of the AMRICC commercialisation facility. Moving forward the MICG partnership will expect to continue collaborative research to strengthen the innovation eco-system. The MICG partners will:

- Collaborate on research that tackles the needs of its industrial base and critical applications required by the UK (such as in defence, nuclear and energy applications)
- Jointly identify and collaborate on funding bids to tackle key MICG priorities such as kiln optimisation, adoption of new kiln technologies, addressing net zero challenges and improving the pace of developing new products.
- Use, promote and support the AMRICC centre to ensure a sustainable commercialisation and pilot line capability in the region.
- Work towards establishing AMRICC in a permanent home in a wider advanced ceramics campus, with strong links to companies and innovation.
- Through the above actions ensure continuity in research and innovation activity to ensure a strong legacy of the SIPF programme.

COLLABORATING TO BECOME MORE EFFICIENT

Many of the advanced ceramics manufacturers are facing the same challenges of needing to reduce costs of production and lowering waste. Where beneficial to members the MICG will seek to address these challenges through partnership work. It will

- Through the research activity of the partnership seek ways that energy use in production can be lowered.
- Exploring through MICG research how wastage of failed products can be lowered
- Through the innovation eco-system ensure that the cost and pace of innovating new products and adopting new production techniques is lowered
- Look at national and international best practice for improved production techniques to promote within the partnership
- Collect and share best practice with regards the re-use of surplus advanced ceramics materials, components, and products at the end of their life-cycle. With MICG members implementing solutions
- Ensuring interaction between researchers, manufacturers and end users to continually explore better ways of working.

COLLABROATING TO IDENTIFY AND ONSHORE CRITICAL MANUFACTURING

MICG partners will look to secure opportunities for on-shoring advanced ceramics production into the Midlands. As part of this work some partners will be involved in:

- Communicating with government the needs of the sector and where vulnerabilities lie
- Proactively conceiving of solutions and projects that address this need
- Playing a role in the delivery of solutions, and ensuring they are embedded in the Midlands advanced ceramics cluster so that local benefits are maximised.

COLLABORATING TO DEVELOP A TALENT PIPELINE

MICG partners, working with regional learning providers, will address the skills gaps and shortages in the sector by working together to develop learning programmes that are specific to the current and emerging needs within the sector. This will include

- Establishing specialist modules, units and short courses that enable entry to the sector by people working on other, aligned areas of manufacturing, building on the work undertaken by AMRICC
- Developing apprenticeships and other vocational qualifications that combine work-based learning with college-based study and which provide progression routes from Level 2 through to postgraduate level skills
- Developing innovative approaches to promoting opportunities within the Advanced Ceramics sector to young people in schools and colleges, including STEM related classroom activities, site and study visits, work experience programmes, summer research placements and competitions to inspire new talent.

SUMMARY AND CONCLUSIONS

The document outlines the strategic priorities and challenges faced by the Midlands Industrial Ceramics Group (MICG) in advancing the Advanced Ceramics sector. It highlights the group's efforts to position the Midlands as a global hub for Advanced Ceramics through collaborative research, innovation, and industry partnerships. Key challenges include high production costs, dependency on overseas materials, and the need for a skilled workforce. The MICG aims to address these by promoting the sector, enhancing efficiency, and developing a talent pipeline through education and training initiatives.

Additionally, the document emphasizes the importance of on-shoring critical manufacturing and fostering a strong innovation ecosystem. The MICG seeks to expand its partnership network and engage with stakeholders to drive technological breakthroughs and strengthen the supply chain.

Those interested in contributing to, or benefiting from, the MICG's initiatives are encouraged to reach out and become part of this collaborative effort to enhance the competitiveness of the Advanced Ceramics sector in the Midlands and UK. Please visit our website for more details about how to get involved.

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