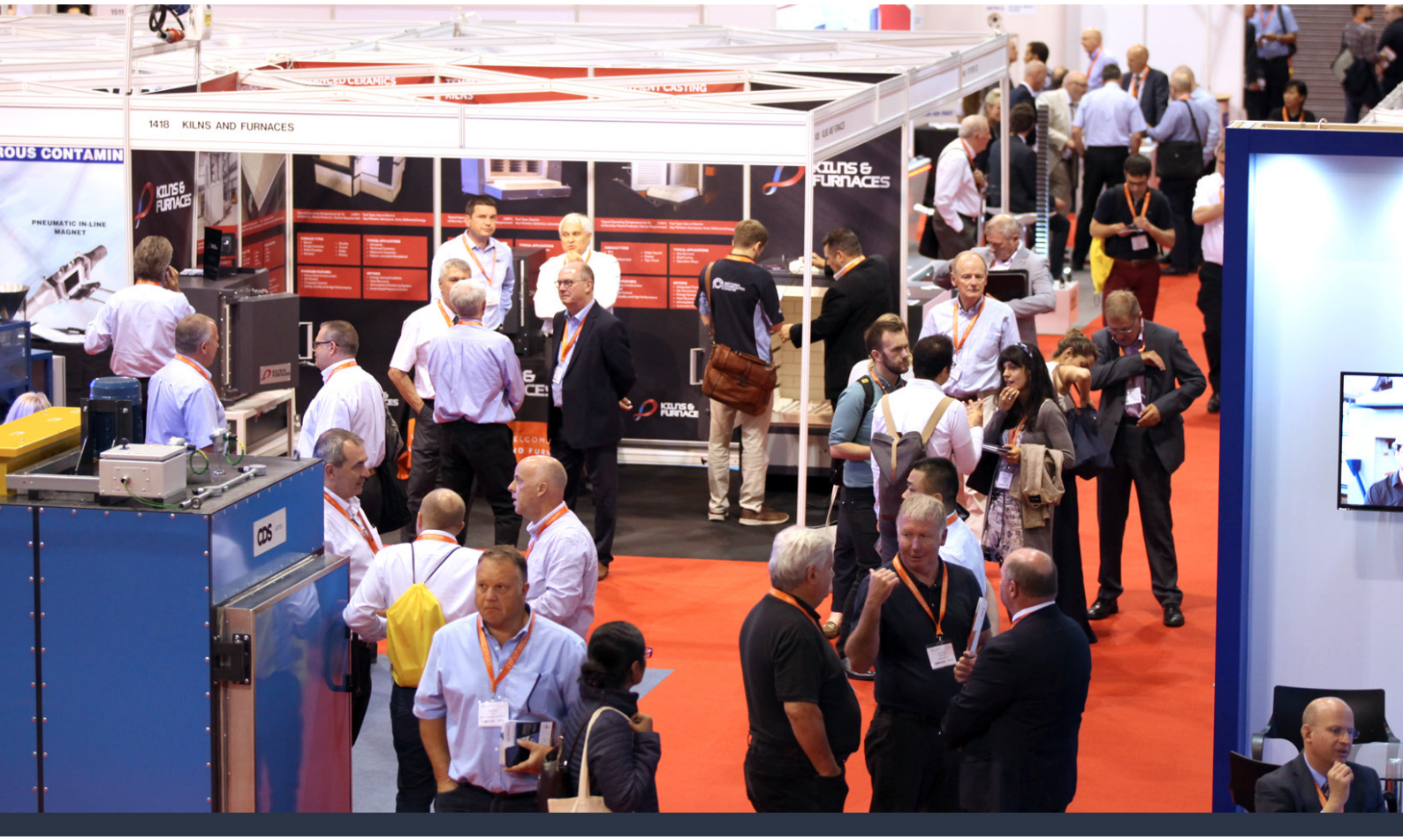
THE Advanced Materials SHOW

CERAMICS UK



The Future of the Technical Ceramics Industry

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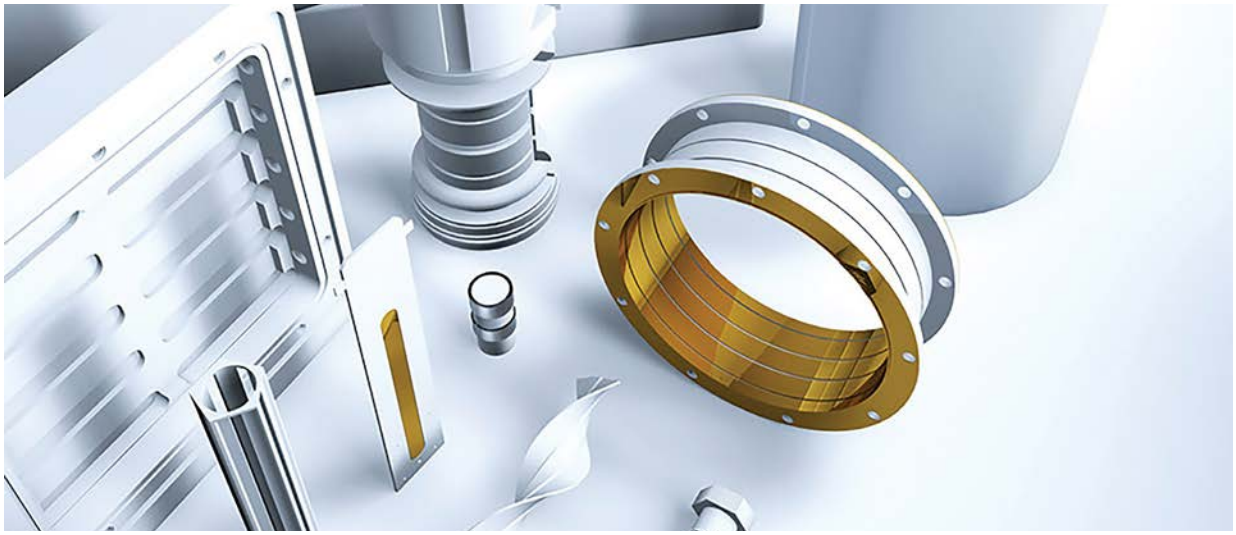
The Future of the Technical Ceramics Industry

As swiftly as novel materials are added to the portfolio, it's with equal speed and enthusiasm we perceive the key role in the future success of engineering industries to be played by technical ceramics in the UK. It can become fashionable to promote the case of one material over another but probably just as important is how they fit in, how flexible they can prove themselves to be, what they bring in terms of design parameters, feasibility of manufacture and supply and, naturally, cost competitiveness.

So, a fair approach when considering bullish industry predictions centres on the 'is it all hype?' question. We can answer that one in succinct fashion – no, it isn't!



In the latest report addressing this manufacturing sector, published in the summer by TMR (Technical Ceramics Market: Global Industry Analysis, Size, Share, Growth, Trends and Forecast), the researchers envisage rapid and sustained expansion at a CAGR of 6.68% for the next eight years, pushing sales over the US$150 billion mark by the end of 2020.

US$150 billion
by the end of 2020

What does this mean for the sector in the UK?

Well, if the ambitions so clearly laid out by the British Ceramic Confederation (BCC) for the industry as a whole are met, something that would see direct and supply-side sales reaching £4 billion in 2020, then at the current rate technical ceramics would account for closing on £500 million in UK-generated sales.

It's arguable that exponential growth in the sector could see this performance exceeded and, of course, the overall revenue contribution to the country is much higher since Britain is home to a couple of globally significant groups with manufacturing plants around the world and multi-million pound sales on their own.

Certainly the forward movement from a trading point of view seems to be borne out by the most recent government generated figures (ONS, September 2019). The Producer Price Index – using weighting against a base year (in this case 2010 = 100) – stayed pretty steady right through from February 2018 to May 2019 for technical ceramics (around 140.8), but has risen in the past few months to 141.2. There has generally been a heightened level of interest from government, recognising the important contribution both economically and technically, due in no small part to the activities of the BCC and the establishment of an All-Party Parliamentary Group for Ceramics.

In the industry itself, development work in the past decade has led to noticeably higher acceptance of advanced ceramic materials by, in particular, design engineers and, as a result, enhanced commercial viability.

> The whole area of technical ceramics in this country – particularly for advanced engineering – has been moving through exciting times during the last industrial cycle and this has led directly to far more interest being shown in these products and an upswing in sales. The sector actually embraces quite different ranges of materials and properties, but a positive impact on both performance and cost fronts is reflected in real, measurable results. If I look at our own position, then just five years ago sales of technical ceramics accounted for 5% of our turnover. Today, that proportion has risen to 20%, which I think tells its own story.

Phil Green
Sales Director, IPS Ceramics

Linking to manufacturing technology research while also focusing on the circular economy and reducing energy demand for material production has an important part to play and the Engineering and Physical Sciences Research Council (EPSRC) continues to help through its Ceramics Research Area. As the team there points out: “In the future, it will be valuable to work more closely with the manufacturing sector...as the use of technical ceramics becomes more important (e.g. implantable devices, sensors, and both functional and structural ceramics for nuclear fusion reactor systems). Ceramics for high-temperature and high-pressure applications remain strategically important, and ceramic matrix composites have the potential to be disruptive technologies in the aerospace and defence sectors.”

The proportional value of the EPSRC portfolio in this area currently amounts to around £10 million, demonstrating once again how seriously the contribution of technical ceramics is being taken.

An overriding factor in the uptake of technical ceramics is the interesting combination of chemical, mechanical, electrical and in-service properties that they possess. These include, but are not confined to, the following:

- Thermal stability
- Wear, corrosion and chemical resistance
- High hardness
- Resistance to thermal shock
- UV resistance
- High mechanical strength
- Electrical insulation
- Electrical conduction
- Biocompatibility
- Electromagnetic compatibility (EMC)
- Potential for miniaturisation
- Potential for transparency (glass-ceramic)
- Low specific weight
- Low friction coefficient
- Low thermal expansion coefficient
- Suitability for high temperature environments
- Long life cycles
- Machinability

Innovators, production managers and design engineers have a wide portfolio of materials – each type offering its own special qualities – from which to choose when it comes to technical ceramics. **Alumina, steatite, electroporcelain and zirconia are very widely used, while silicon carbide (SiC) is increasingly presenting itself as a material of choice for a wide range of applications.** Other specialist but no less important members of the family include aluminium nitride, silicon nitride, boron nitride, boron carbide, advanced cordierite, YTZP, glass-ceramics and hybrids such as ATZ.

We are no doubt all familiar with some standard electrical products, an area where technical ceramics were able to make an impact many decades ago, but perhaps less so with advanced manufacturing components in which their role today is invaluable. The dominant user sectors, and drivers for change and quest for excellence, are automotive, space/aerospace, medical, energy, electronics and defence.

Another consideration, and a challenge for British industrial engineers, is how technical ceramics are manufactured, rather than just where they are used. This lays down challenges for systems and equipment suppliers, sometimes resulting in a sea change in approach. Not just that, but a boost in business.

Here is Simon Ayling, European Managing Director of Bunting, world leaders in magnetic technology, magnetic separation equipment and metal detection systems:

> In 2019, the Bunting team has been discussing issues of iron contamination with specialist ceramics manufacturers, especially from the technical sector. Companies have adapted the ceramics expertise of a skilled and knowledgeable workforce, applying it to manufacture specialist ceramic products. For these there is less competition from the high volume, low cost economies such as China. For Bunting, the change has breathed new life into sales for high strength magnetic separators. Higher specification ceramics mean an increased need for enhanced iron removal. The UK has always held a global reputation as a leader in ceramics production, although as we approach 2020 it is simply in a more specialist field. Long may it continue.

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In the context of Ceramics UK, we cannot ignore the automotive sector, in particular Britain's burgeoning electric and hybrid vehicle (EV/HEV) industry and crucial associated technologies such as battery cell and thermal management systems.

It is significant that The Advanced Materials Show and Ceramics UK will take place at NAEC Stoneleigh (seven miles south of Coventry) as this places it down the road from Jaguar Land Rover, London Electric Vehicle Company, Coventry University, University of Warwick, WMG's Energy Innovation Centre, the National Automotive Innovation Centre and the brand new £126 million UK Battery Industrialisation Centre due to open next year.

Technical ceramic components already feature across the EV spectrum and, as one leading global manufacturer recently said, “are highly reliable in extreme duty applications to last (or outlast) the lifetime of the equipment, making them nearly essential to hybrid and electric vehicles…(these) products are infinitely customisable.” We see everything from microelectronics, bearings, seals, pump components, lighting, and electrical insulating materials to cladding, speciality coatings, high-performance sensors, power electronics, thermal management systems, sound abatement and advanced screens and visualisation.

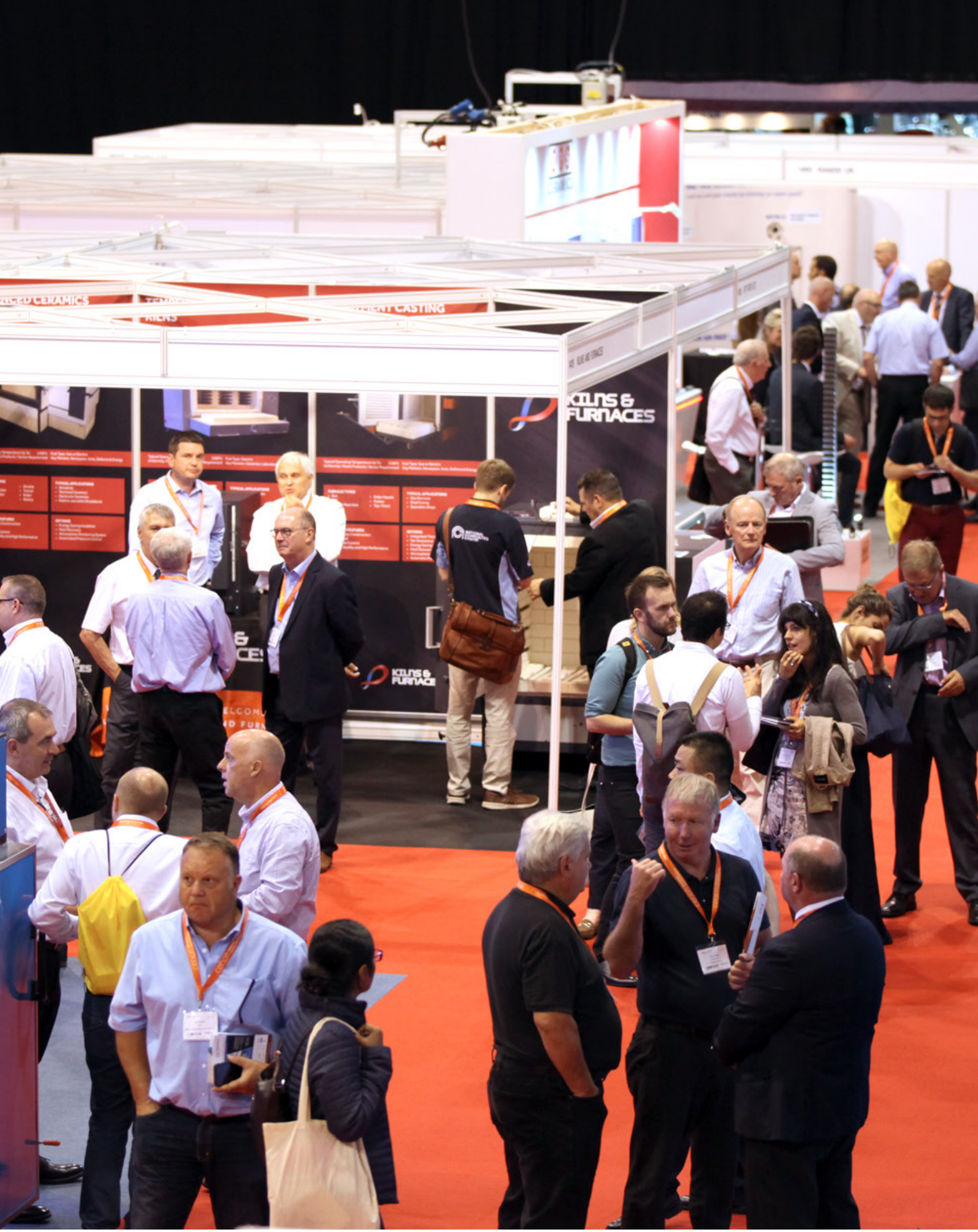
In just this one area it’s clear that exciting times lie ahead. The latest figures from The Society of Motor Manufacturers and Traders (SMMT) show all-electric vehicle registrations for September 2019 up nearly 240% over September 2018, in which time the EV market share has trebled. HEV and PHEV registrations were also up, while there was significant progress in much smaller, specialist areas – MHEV (diesel) up 678% and MHEV (petrol) up 92%.

Furthermore, this is by no means the extent of the potential offered to the ceramic industry by e-mobility transformation. Connected and autonomous vehicles (CAVs) are predicted to make a major impact within a generation. They are planned to be on some of our roads by 2021 and the UK Government’s Centre for CAVs estimates that this country’s market for connected and automated vehicles will be worth £52 billion by 2035.

We haven't spoken yet about operating at the nanoscale. **The UK has been at the forefront of much important work in this field, such as at WMG at the University of Warwick (a founding partner of the new co-located exhibitions at Stoneleigh).** WMG has a research programme on ceramic nanomaterials that focuses on the processing and characterisation of ceramic materials and highly-loaded polymer-ceramic nanocomposites for a range of functional and structural applications.

It carries out experiments to understand how to enhance and control the mechanisms which lead to optimal microstructure of the material, such that the processing can be optimised and made as efficient as possible. Applications for these nanoceramics are wide ranging and include materials for acoustic damping, solid state batteries, superconducting magnets, ceramic armour materials, metamaterials for electromagnetic devices, wear surfaces, all-ceramic joints and biomaterial bone replacement scaffolds.

Despite some wider business opportunities afforded by the presence of large international players, around 75% of manufacturers and suppliers in the British ceramic industry are SMEs. We should recognise what this brings when it comes to the ability to adapt, willingness to innovate, and close connection with markets. As Richard Gnodde, CEO of Goldman Sachs International, emphasised at the recent Business 2030 conference (in the context of the GS 10,000 Small Businesses UK programme): "Small businesses are responsible for the majority of all private sector turnover and employment in the UK. Not only are they critical to national prosperity, they are at the heart of our communities. They are dynamic and agile innovators."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About the Advanced Materials Show and Ceramics UK

Spread over two action-packed days, The Advanced Materials Show will offer an unrivalled insight into current and future materials development, with experts from all sides of the industry in attendance.

- **Free-to-attend exhibition and world-class conference** dedicated to high-performance materials technology. Register here.
- **Over 300+ exhibitors and 4,000 visitors**, including project managers, design engineers, buyers, materials scientists and senior executives.
- **Multi-track conference** with tracks dedicated to Graphene, 2D Materials and Nanomaterials; Surface Engineering & Advanced Coatings; Composites & Polymers.
- Co-located with **Battery Cells and Systems Expo and Vehicle Electrification Expo**.
- **Modern materials innovation across industries** including space/aerospace, automotive, energy, renewables, medical, electronics, construction and defence.
- **Materials on display** will include the latest in nanomaterials, composites, polymers, ceramics, adhesives and sealants, coatings, foams, metals, textiles and thermoplastics.
- **An advisory panel featuring leading names** from organisations including **3M, Cerion, Imperial College, Graphene@Manchester, Innovate UK and Nanotechnology Industries Association.**

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