BUILDING BRITISH INDUSTRY · PAPER 03

Paper III: Advanced Materials

Discovery, qualification, rare earth magnets and forging capacity.

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Every advanced industry is built from materials. The magnets in a wind turbine or a guided missile, the alloys in a jet engine, the composites in an aircraft wing, the wafers in a power chip and the forgings in a nuclear reactor all decide what can be made and who can make it. A country that cannot make its own materials depends on others for everything built from them.

Britain is unusually strong at the start of this chain. Graphene was first isolated in Manchester, the Henry Royce Institute leads a national network of materials research, Liverpool's Materials Innovation Factory pioneered robotic laboratories that discover new materials largely by themselves and the materials sector already supports around 635,000 jobs. Yet Britain is weak at the point where a promising material becomes an approved, manufactured and exported product. Qualifying a new material for an aircraft, a reactor or a medical device can take a decade or more, pilot-scale facilities are scarce and expensive, and the capital to build the first factory is hard to find. In 2025 Britain lost its planned rare earth refinery for want of a domestic backer.

Artificial intelligence is about to change the economics of this field. Models trained on the properties of known materials can now propose new ones, and robotic laboratories can test them faster than any team of researchers. The countries that combine that speed of discovery with fast qualification and the capacity to manufacture at scale will capture much of the value of the next generation of industry. Britain has the science, the institutions and, through the sovereign artificial intelligence programme, a laboratory with a materials division of its own.

This paper sets out a mission to turn that position into production. It treats materials as a single pipeline running from discovery through qualification and scale-up to manufacture, and it proposes measures at each stage, located in the regions that already hold the capability and paired with the technical institutions proposed in Building British Skills.

1 Where the pipeline breaks

Britain's materials sector is large and widely spread, but its strength is concentrated in research rather than production, and its supply of the most strategic materials depends on a single foreign source.

MEASURE	FIGURE
Gross value added of the UK materials sector	About £49 billion a year
Jobs in the UK materials sector	About 635,000

MEASURE	FIGURE
Share of materials businesses outside London and the South East	About 70%
China's share of world rare earth refining	About 90%
Commercial-scale sintered rare earth magnet factories in the UK	One, a recycling plant in Birmingham opened in 2026

Discovery is not the problem. Britain's universities and institutes produce materials research of world standing, and the National Materials Innovation Strategy has set out a credible plan for the research base. The failures come later, and they compound one another.

Qualification is the first bottleneck. A new alloy, composite or ceramic cannot be used in an aircraft, a reactor or a defence system until it has been tested exhaustively and approved by a regulator or a prime contractor. Each firm and each programme tends to generate its own test data from scratch, and regulators rarely accept evidence generated for another purpose. The result is that qualification often takes longer and costs more than discovery, and small firms with better materials cannot afford it.

Scale-up is the second. Moving from grams in a laboratory to tonnes in a plant requires pilot facilities that few firms can justify building alone. Britain has some of the best, including the National Composites Centre, the Advanced Manufacturing Research Centre, the Materials Processing Institute and the UK Battery Industrialisation Centre, but capacity is limited and access is uneven.

Production is the third. The first factory for a new material is a large, risky investment with a long payback, precisely the kind of project British capital markets avoid. Where the material is strategic, as with rare earth magnets, the competing supply often comes from producers that do not need to make a commercial return. The government's critical minerals strategy rightly sets goals for domestic production, recycling and the diversity of supply by 2035, but its new funding of up to £50 million is small against the scale of the plants required.

2 Principles

One pipeline, not separate programmes. Discovery, qualification, scale-up and production should be planned and funded together, so that a material discovered in Britain has a route to being made in Britain.

Speed of qualification is a national asset. The country that can approve a safe new material fastest will attract the firms that make it, so shared test data and digital qualification should be treated as public infrastructure.

Own the strategic materials. Britain should be able to make the materials on which its defence, energy and advanced industries depend, starting with permanent magnets and the largest reactor forgings.

Build where the capability is. Each stage of the pipeline should be located in the regions that already hold the relevant institutions, firms and workforce.

Public anchor, private ownership. The state should act as first customer, anchor investor and provider of shared facilities, with conditions that keep capability in Britain, and should own a business outright only where no private investor will build it.

3 Discovery

M1 Build a national materials discovery network

Link the materials division of the British Frontier AI Laboratory with the Henry Royce Institute and its partner universities, the Materials Innovation Factory in Liverpool and the National Graphene Institute in Manchester to form a national materials discovery network. The network will combine artificial intelligence models that propose new materials with robotic laboratories that make and test them, and will focus its work on the materials the missions need, beginning with magnets that use fewer rare earths, high-temperature alloys, composites, ceramics, battery materials and semiconductor materials.

The data generated by publicly funded laboratories and facilities will be pooled in a national materials data commons, held to common standards and open to British researchers and firms on fair terms. A large, well-curated body of measured properties is what artificial intelligence models need to make reliable predictions, and it is a public good that no single firm will build.

4 Qualification

M2 Create a national materials qualification service

Establish a national materials qualification service, led by the National Physical Laboratory and delivered through the High Value Manufacturing Catapult and the materials pilot facilities in M3, to generate test data that every regulator and prime contractor will recognise. The service will publish standard test methods, run shared qualification programmes for classes of material and develop qualification based on modelling and simulation, so that fewer physical tests are needed to prove a material safe.

The regulators and public buyers that approve materials, including the Civil Aviation Authority, the Office for Nuclear Regulation, the Medicines and Healthcare products Regulatory Agency and Defence Equipment and Support, will be required to accept data from the service where it meets their standards, rather than requiring each applicant to repeat it, and to assess only what differs in a material's form, processing or intended use. The mission's goal is to halve the time taken to qualify a new material for its first use in the priority sectors within ten years.

5 Scale-up

M3 Open a network of materials pilot facilities

Expand and connect the existing pilot facilities into a national network open to any British firm on published terms, covering composites at the National Composites Centre, metals and alloys at the Advanced Manufacturing Research Centre, the Advanced Forming Research Centre and the Materials Processing Institute, battery materials at the UK Battery Industrialisation Centre, compound semiconductor materials in South Wales and magnet production in the Midlands. Funding will pay for additional capacity and for access by smaller firms, with each facility judged on how many materials it moves into production.

6 Production and strategic materials

M4 Build a British rare earth magnet industry

Build a domestic supply chain for rare earth magnets, from the separation of rare earths to the manufacture of sintered magnets and their recycling. The state will act as anchor investor through the National Wealth Fund and as anchor customer through long-term offtake agreements with the Ministry of Defence, which uses magnets in guidance systems, motors and sensors, and with the wind and automotive industries. Separation will be located on the Humber, where a site with planning consent already exists, and magnet manufacture and recycling will build on the plant opened in Birmingham in 2026 and on the research base at the University of Birmingham and Queen's University Belfast.

The mission adopts and extends the goals in the government's critical minerals strategy. In addition to its targets for domestic production, recycling and diversity of supply, Britain will aim to meet all of its defence demand for permanent magnets from domestic or allied production by year six and to supply a tenth of world production of separated magnet rare earths within twenty years.

These two goals need separate commercial cases. Security of supply for defence is a public good, and the Ministry of Defence will pay the premium it requires through long-term offtake contracts at a guaranteed price for a defined volume, in the way contracts for difference guarantee a price for low-carbon power. Winning a share of the world market is a commercial goal that must be met at competitive prices, supported by the shared facilities and capital in this paper rather than by permanent subsidy. Because the world market for rare earths is dominated by producers that need not earn a commercial return, the offtake contracts will be designed to keep domestic plants operating through periods of sustained overseas price suppression, and Britain will use its trade remedies regime against dumping where the evidence supports it. Initial capital alone does not secure continuing operation, and the contracts are what make the plants viable over their working lives.

Rare earths are not the only critical mineral Britain can produce. The same combination of anchor investment and offtake will be available, within this measure, for lithium extraction in Cornwall, where the deposits identified in the critical minerals strategy are being developed, and for lithium refining on Teesside, so that the batteries made in Britain can draw on domestic supply.

In the longer term, the charter cities proposed elsewhere in this manifesto could host the processing of copper, cobalt, lithium and other critical minerals under British law on routes from the regions that produce them, adding a further secure source of supply for British industry.

M5 Expand nuclear and defence forging capacity

Extend the recapitalisation of Sheffield Forgemasters, in which the state has already committed more than £1.3 billion, so that it can supply the largest components for civil reactors, including small modular reactors, alongside its work for the submarine programme and other defence projects. Forgemasters will remain state-owned while the national need for sovereign forging capacity persists, with its civil work run on commercial terms and its expansion sequenced against firm reactor orders.

M6 Anchor demand for composites, semiconductor and battery materials

Agree long-term demand compacts with the prime contractors and public buyers that use advanced materials, including aerospace and defence primes, the automotive and battery industries and the compound semiconductor cluster, under which suppliers that pass qualification receive multi-year orders specified by performance, resilience and whole-life cost, in line with C5 of the sixth paper, rather than by origin. Public buyers, including defence, rail, energy networks and the nuclear estate, will specify materials by performance rather than by name, so that a qualified British material can compete with an incumbent.

7 Skills

M7 Train the materials workforce in the materials regions

The sector skills bodies established under S14 of the second skills paper will give priority to the occupations on which the materials pipeline depends, and British Master qualifications under S15 will be developed early in metallurgy, forging, composites, ceramics and materials testing. Universities of Technology in the materials regions will be linked to the pilot facilities in M3, so that students train on the equipment industry uses. Materials science and metallurgy will be added explicitly to the designated strategic subjects under S5 of the first skills paper, so that accredited courses are funded for their full length.

8 Ambition

The mission carries goals for market share and for capability, consistent with those in the first paper.

GOAL	MEASURE	BY
Rare earth separation and permanent magnets	A tenth of world production of separated magnet rare earths, measured as output from plants located in Britain, against a market forecast to grow from $10.8 billion in 2023 to $56.7 billion by 2040 (Adamas Intelligence)	Year 20
Semiconductor materials	5% of the whole world market for semiconductor materials, worth $73 billion in 2025 (SEMI), concentrated in compound semiconductor and specialist materials	Year 20
Defence magnets	All defence demand for permanent magnets met from domestic or allied production	Year 6
Qualification	Time to qualify a new material for first use in priority sectors halved	Year 11
Discovery to production	Materials discovered through the national network in serial production in Britain	Reported each year

9 Regions

The materials pipeline runs through several of the production regions designated under P1 of the first paper.

REGION	ROLE IN THE PIPELINE	EXISTING FOUNDATIONS
Greater Manchester and Liverpool	Discovery, graphene and artificial intelligence for materials	Henry Royce Institute hub, National Graphene Institute, Materials Innovation Factory

REGION	ROLE IN THE PIPELINE	EXISTING FOUNDATIONS
South Yorkshire	Alloys, machining and the largest forgings	Sheffield Forgemasters, AMRC, Nuclear AMRC
Humber	Rare earth separation	Saltend Chemicals Park, Humber Freeport
Midlands	Magnet manufacture and recycling, battery materials	Magnet recycling plant at Tyseley, University of Birmingham, UK Battery Industrialisation Centre
West of England	Composites for aerospace, defence and space	National Composites Centre
South Wales	Compound semiconductor materials	Compound semiconductor cluster around Newport
North East England	Process scale-up and metals processing	Materials Processing Institute, CPI
West of Scotland	Metal forming and process manufacturing	Advanced Forming Research Centre within NMIS

10 Cost

The mission is costed as a single estimate of about £3.5 billion of public money over ten years. The estimate is built from the cost of each measure, with a contingency of a quarter added to reflect the early stage of the design.

MEASURE	TEN-YEAR COST	BASIS
M1 Discovery network and data commons	About £300m	Three linked hubs at the scale of the £100m AI materials hub planned in Liverpool
M2 Qualification service	About £300m	Qualification capacity at the National Physical Laboratory, the Catapults and the pilot facilities
M3 Pilot facility network	About £550m	Additional capacity at the existing pilot facilities and access for smaller firms
M4 Rare earth magnets	About £1bn	Anchor equity and loans for separation, magnet manufacture and recycling, largely through the National Wealth Fund
M5 Forging capacity	About £500m	Civil reactor capacity in addition to the £1.3bn already committed
Programme delivery	About £100m	Mission team and evaluation
Contingency	About £700m	A quarter of the total above
Total	About £3.5bn	Of which around £1bn is expected to be equity and loans rather than spending

The demand compacts in M6 work through existing procurement budgets, and the skills measures in M7 are funded through the National Skills Account and the institutions set out in Building British Skills. The cost of the mission is part of the combined budget set out in the funding note, which draws first on

existing business support and on the public investment banks.

11 Territorial application

The materials mission operates across the United Kingdom as part of the industrial strategy. The skills measures apply in England, and the government will seek agreement with the devolved administrations to extend them to production regions in Scotland, Wales and Northern Ireland, as set out in the first paper.

FIELD	APPLICATION
Discovery network, qualification service and pilot facilities	United Kingdom
Rare earth magnets and forging capacity	United Kingdom
Recognition of qualification data by regulators	United Kingdom, for reserved regulators, and by agreement where regulation is devolved
Skills measures	England, and by agreement in Scotland, Wales and Northern Ireland

12 Legislation and delivery

INSTRUMENT	MEASURES	CONTENT
Industrial Strategy Bill	M2 and M4	The duty on regulators and public buyers to recognise qualification data and the holding arrangements for strategic capability stakes
Funding and procurement policy	M1, M3, M5 and M6	Funding of the discovery network, pilot facilities and forging capacity, and the demand compacts
Skills and Higher Education Bill and secondary legislation	M7	Master qualifications in materials trades and the designation of materials science and metallurgy as strategic subjects

Britain gave the world graphene and much of the science of modern materials. The task now is to make sure that the next generation of materials is not only discovered here but made here.