Centre for WTO Studies

INDUSTRIAL SUPPLY CHAIN SERIES

Critical Materials for Critical Industries: India's Advanced Ceramics Opportunity

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1. Introduction and Context[1]

Advanced ceramics, often referred to as technical or industrial ceramics, are engineered materials capable of operating under extreme mechanical, thermal, chemical, and electrical environments beyond the physical limits of metals and polymers. They serve as critical inputs across high-technology industries, with electronics and semiconductors representing the dominant demand segment, followed by transportation, industrial machinery, energy systems, healthcare, and defence, as outlined in Table-1.

Table-1: Key End-User Segments, Applications & Demand Share

Segment	Key Applications of Advanced Ceramics	Share of Global Advanced Ceramics Demand (%)
Electronics & Semiconductors	Substrates, chip packaging, circuit components, insulators, thermal management	40–45%
Electric Mobility (EVs)	Inverter substrates, power electronics modules, bearings, sensors, insulation	10–12%
Aerospace & Defence	Armour ceramics, radomes, heat shields, missile & aircraft components	8–10%
Medical & Dental Devices	Bioceramic implants, bone grafts, dental ceramics, surgical tools	10–12%
Industrial Machinery	Bearings, seals, wear parts, cutting tools, linings	12–15%
Energy & Clean Technologies	Fuel cells, hydrogen electrolysers, SOFC components, insulation	5–7%
Chemical & Process Industries	Reactor linings, labware, corrosion-resistant components	3–5%
Optics & Advanced Protection	Transparent ceramics for thermal imaging, helmets, goggles	<3% (emerging)

Source: Author's calculation on the data provided by Industry Reports.

Reflecting this broad-based demand, the global advanced ceramics market is valued at USD 104.34 billion in 2025 and is projected to reach USD 144.44 billion by 2030 (CAGR 6.72%)[2]. Regionally, Asia–Pacific remains the largest and fastest-growing market[3], supported by sustained investment in electronics and semiconductor manufacturing, while North America and Europe continue to expand on the strength of established industrial capabilities. Healthcare—particularly bioceramics—is among the fastest-growing application segments globally.

Advanced ceramics production is organised around a multi-stage value chain in which value creation is concentrated in mid-stream process technologies rather than in raw material extraction or final assembly[4]. Material performance is driven primarily by chemical purity and grain-size

[1] The Authors would like to acknowledge sincere efforts provided by Mr Saptarshi Chatterjee, Ms Soumi Chowdhury, Ms Poorva Singh, Mr Anmol Gera and Ms Mallika Dutt.

[2] https://www.mordorintelligence.com/industry-reports/advanced-ceramics-market

[3] Capturing 54% share of the advanced ceramics market in 2024 and is expected to post a 7.06% CAGR through 2030

[4] https://www.factmr.com/report/2993/advanced-ceramics-market

control[5], rendering stages such as high-purity powder processing, advanced sintering, precision machining, and functional integration highly capital and knowledge intensive and concentrated in a limited set of economies (Table-2). This structural concentration explains the persistent import dependence of emerging markets despite expanding demand. For India, it results in a pronounced asymmetry: strong participation at the upstream and downstream ends of the value chain, but heavy reliance on imports for high-value intermediate stages. The binding constraint, therefore, lies not in demand or raw material availability, but in missing mid-stream process capabilities.

Table-2: Advanced Ceramics Value Chain and India's Position

Value Chain Stage	What Happens at This Stage	Representative Products	Global Leaders	India's Current Position
Mineral Extraction & Primary Inputs	Mining and beneficiation of bauxite, zircon, silica, borates, rare earths	Bauxite, zircon sand, silica	Australia, South Africa, India	Strong mineral base; exporter of raw minerals
Chemical Refining & Purification	Conversion of minerals into ultra-pure ceramic precursors	High-purity alumina (99.9%+), zirconia powders, yttria	Japan, China, Germany	Very limited high-purity refining capacity
Advanced Powder Processing	Nano/micron-scale powder synthesis, doped powders, granulation	YSZ powders, AlN powders, SiC, Si_3N_4 powders	Japan, US, Germany, China	Negligible commercial capability
Shaping & Forming	Isostatic pressing, tape casting, injection molding	Green ceramic parts, substrates	Japan, Germany, US	Small-scale, mostly R&D-level
Sintering & Densification	High-temperature sintering, HIP, atmosphere-controlled firing	Dense ceramic bodies, substrates	Japan, Germany, US	Limited access to HIP and advanced kilns
Precision Machining & Finishing	CNC machining, lapping, polishing to micron tolerances	Bearings, seals, medical implants, substrates	Germany, Japan, Switzerland	Minimal industrial capability
Functional Coating & Integration	Metallization, brazing, multilayer integration	Power modules, chip packages	Japan, South Korea, Taiwan	Almost absent
End-use Component Manufacturing	Assembly into final functional products	EV power substrates, armour tiles, medical implants, semiconductor parts	Japan, US, Germany, China	Limited niche (defence labs, small firms)
System Integration & Final Products	Integration into EVs, electronics, defence systems	EV inverters, fabs, missiles, implants	Global OEMs	Growing downstream demand; assembly strong

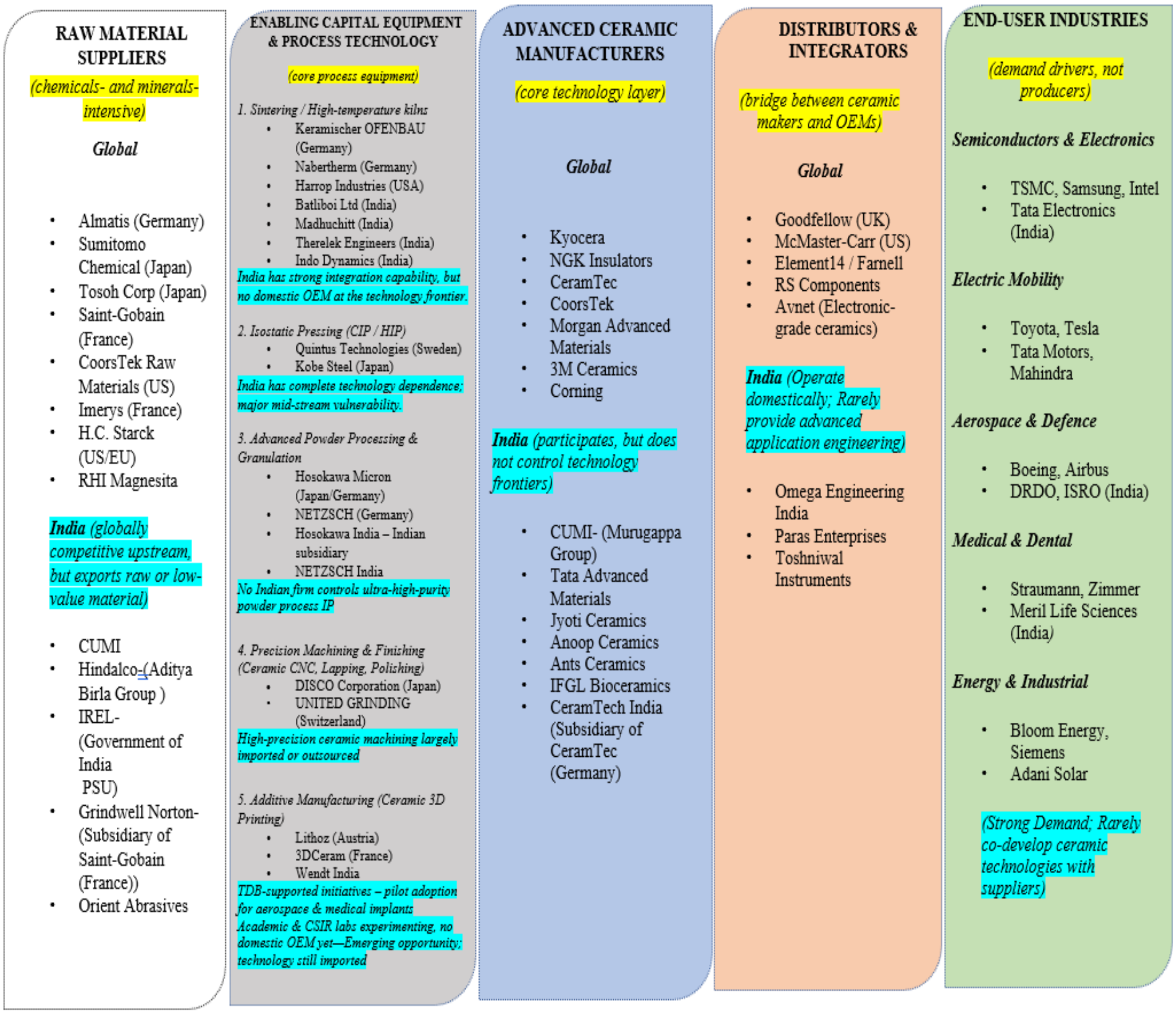
Source: Author's conceptualization of value chain. Green and orange colors signal India's low and high import reliance.

Extending this value-chain asymmetry to the firm level, Figure 1 shows that Indian firms are concentrated in raw material supply, distribution, and downstream integration, reflecting strong industrial scale and expanding end-use demand. In contrast, technology-owning manufacturers—

[5] Even 0.1% of an impurity can cause an implant or electronic substrate to fail

those controlling proprietary processes, specialized equipment, and application-specific know-how are predominantly global players. Advanced ceramic production in India remains limited to niche segments or foreign-owned subsidiaries[6], restricting domestic technology ownership and learning spillovers. This ecosystem structure reinforces India's dependence on imported advanced ceramic inputs and highlights the gap between market scale and manufacturing control.

Figure-1: Global and Indian Advanced Ceramics Industry Ecosystem[7]



Source: Authors adaptation from various industrial report

With demand for advanced ceramics expanding across regions and end-use sectors, global trade flows provide a useful lens to understand how demand is met, which economies capture value, and where supply-side capabilities are concentrated.

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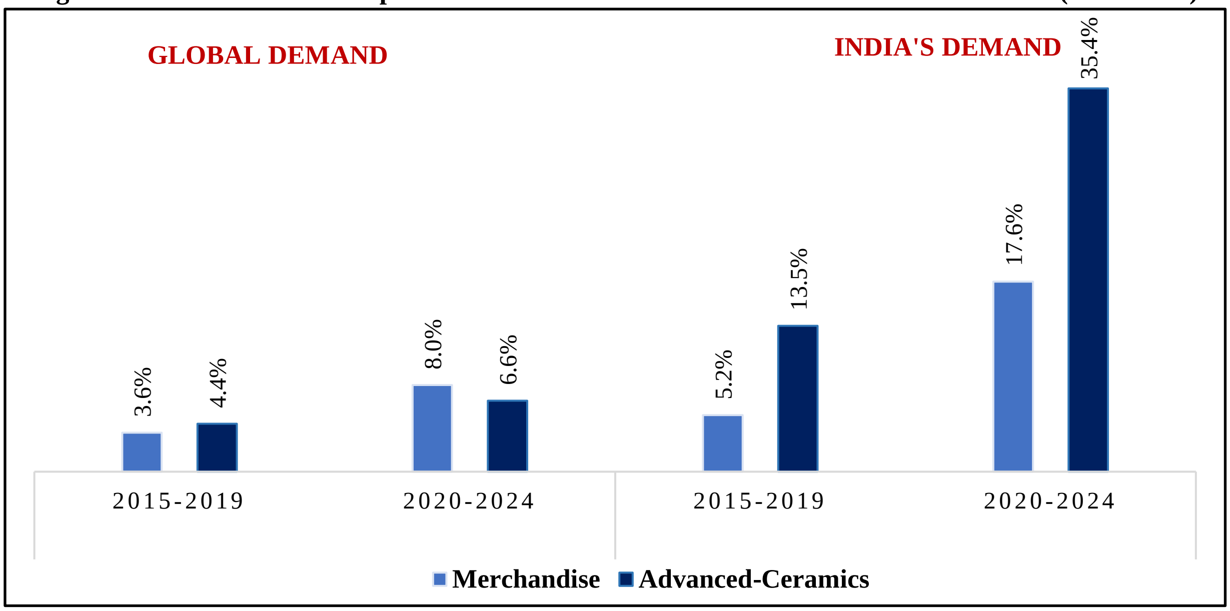
[6] https://www.fortunebusinessinsights.com/advanced-ceramics-market-105073

[7] The figure reflects the ecosystem of leading participants in raw materials, manufacturing, distribution, and end-use sectors for advanced ceramics.

2. Global Trade Patterns in Advanced Ceramics

Global trade in advanced ceramics has expanded steadily over the past decade. Global imports increased from about USD 5.8 billion in 2015 to nearly USD 8 billion in 2024, with import growth accelerating from around 4.4% in the pre-pandemic period to about 6.6% during 2020–2024 (Figure 2). Although advanced ceramics imports grew marginally slower than overall global imports over 2015–2024, the sustained expansion in both value and growth highlights their increasing structural importance as critical inputs in high-technology manufacturing. At the same time, trade remains highly concentrated among a small group of producing economies—Germany, the United States, Japan, China, and South Korea—underscoring persistent supply-side concentration even as global demand expands

Figure-2: Global vs India—Import Growth Rate of Advanced Ceramics and Merchandise (2015–2024)



Source: ITC TradeMap

However, India's trajectory diverges sharply from global trends. Advanced ceramics imports have grown significantly faster than India's overall imports across all periods, with a pronounced post-pandemic surge of 35.4% during 2020–2024—far exceeding global growth rates. This reflects the rapidly rising importance of advanced ceramics for India's industrial and technological expansion. While domestic production has expanded in scale in response to this demand, evidence suggests it remains uneven and insufficient to offset rising import dependence (see Section 2). India's imports are sourced primarily from China, Germany, Japan, and the United States, underscoring continued reliance on established global suppliers[8]. By 2024, India ranked sixth globally among importers of key ceramic wares for chemical or other technical uses (HS 690919). Together, these trends point

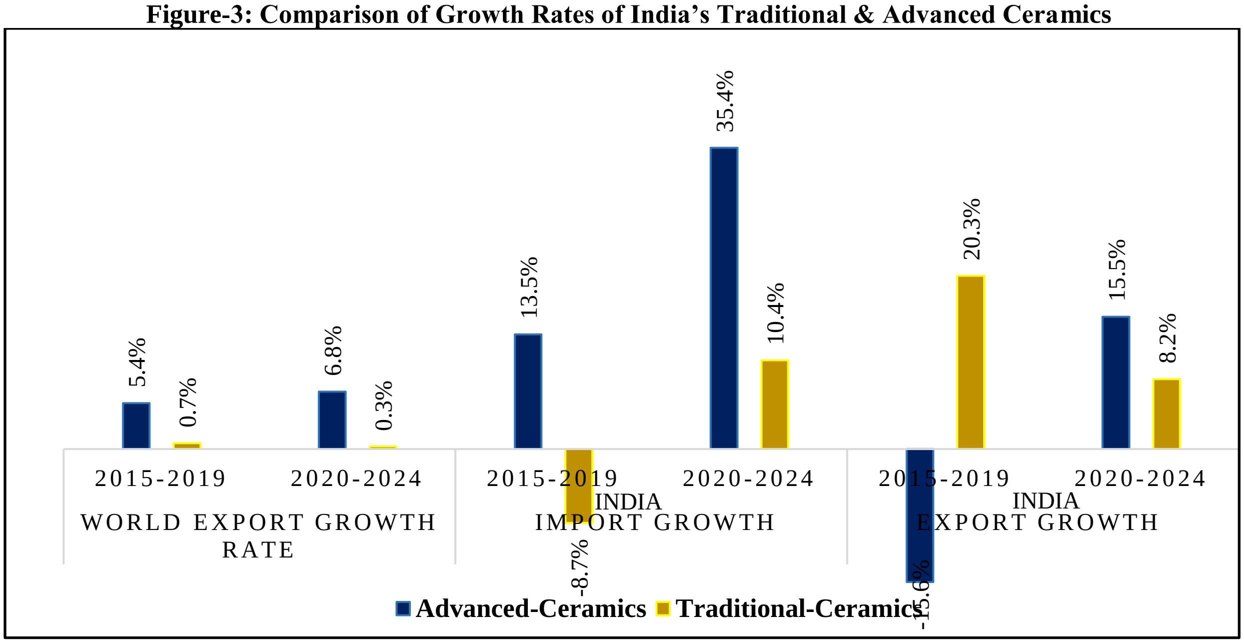
[8] https://www.6wresearch.com/industry-report/india-advanced-ceramics-market-outlook

to a widening gap between India's expanding downstream demand and its limited domestic supply capabilities, reinforcing dependence on imported high-performance intermediates.

As can be seen from import trends in Figure 2, India's dependence on advanced ceramics stands in sharp contrast to its strong position in traditional ceramics. India is a globally competitive producer and exporter of tiles, sanitaryware, refractories, and abrasives[9][10], supported by scale advantages, cost competitiveness, and a mature manufacturing ecosystem, as reflected in robust export growth (Figure 3). Advanced ceramics, however, display a fundamentally different trade profile—characterized by high import growth and weak export performance.

This divergence indicates that while India has achieved global competitiveness in traditional ceramics, rapidly rising demand for advanced ceramics is being met largely through imports. Spillovers between the two segments exist but remain limited. India's strengths in ceramic processing, kiln operation, materials handling, and large-scale manufacturing provide an important foundation[11]; but, the absence of critical mid-stream capabilities—such as ultra-high-purity powder processing, advanced sintering, precision machining, and application-specific integration—continues to constrain competitiveness in advanced ceramics.

Figure-3: Comparison of Growth Rates of India's Traditional & Advanced Ceramics



Source: ITC TradeMap

[9] https://www.cbisexpo.com/post/india-a-rising-powerhouse-in-the-ceramic-tile-world#:~:text=Did%20you%20know%20India%20is,ll%20witness%20its%20finest%20creations.

[11] Morbi Cluster: While 90% of Morbi's output is tiles/sanitaryware, many factories are upgrading to hydrogen-ready klins and digital printing, moving toward more "advanced" manufacturing

However, Figure 3 highlights a notable post-pandemic shift. During 2020–2024, both import and export growth rates of advanced ceramics outpaced those of traditional ceramics, reflecting surging domestic demand alongside early—though still limited—export momentum. This pattern is consistent with post-pandemic supply-chain reconfiguration, greater emphasis on strategic materials, and initial domestic capability development. Traditional ceramics, by contrast, exhibit more moderate growth consistent with industry maturity. Together, these trends indicate that advanced ceramics may be beginning to move beyond pure import dependence toward early-stage export participation[12], reinforcing the case for targeted policy interventions to translate India's traditional ceramics strengths into competitive advanced ceramics manufacturing.

This divergence is further reflected in firm-level trade participation. India's IEC[13] and shipment data (Table 3) seem to indicate a mature, large-scale ecosystem in traditional ceramics—with over 1.5 lakh export shipments and more than 10,000 exporting IECs—alongside a much smaller and more specialized base in advanced ceramics, involving only around 2,500 IECs on both the import and export sides. The limited number of firms and relatively low shipment volumes in advanced ceramics most likely point to continued import dependence and capability constraints. Taken together, these patterns point to a structural divide between India's export-led traditional ceramics sector and high technology-intensive advanced ceramics segment, where domestic manufacturing depth remains limited.

Table-3: India's Importer Exporter Code (IEC) data and shipment records

Products	Imports		Exports	
	BOE Count	**IEC Count**	**SB Count**	**IEC Count**
Advanced ceramics	11225	2587	16520	2686
Traditional Ceramics	22103	5692	151567	10932

Source: DGCIS

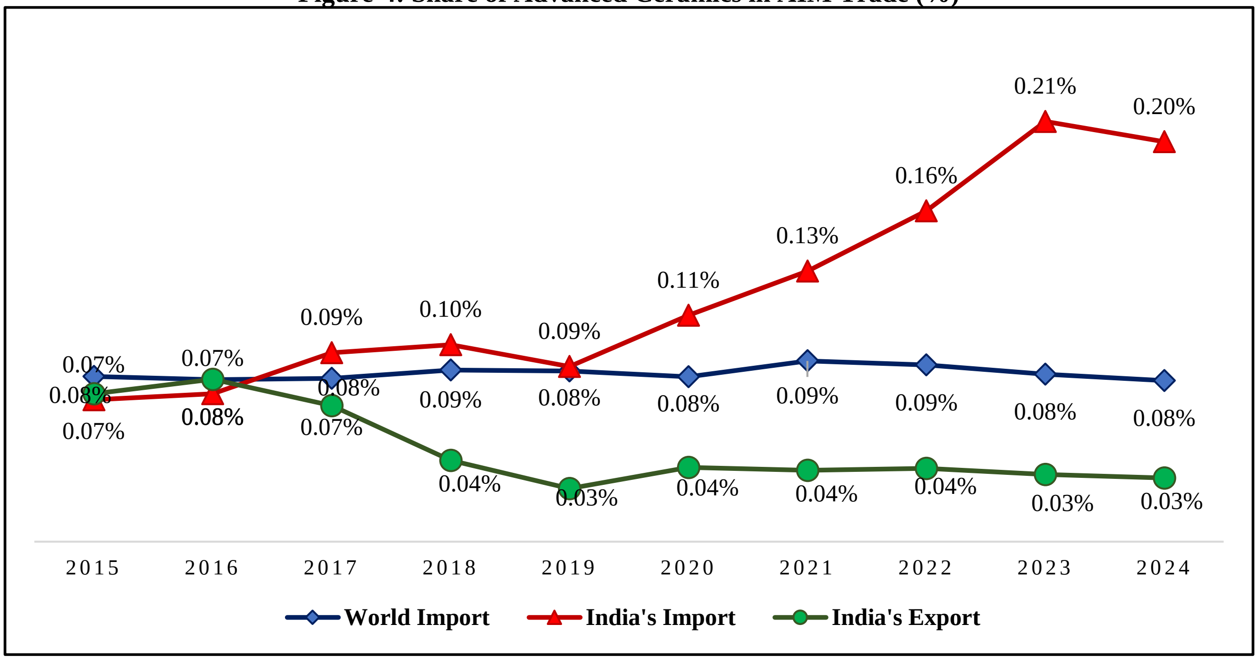
2.1 Advanced ceramics within Advanced Industrial Manufacturing (AIM)

The strategic importance of advanced ceramics is further evident from their role in AIM sectors[14] (Figure 4), where demand is expanding rapidly alongside India's broader industrial upgrading. Globally, advanced ceramics account for a stable 0.07–0.09% share of AIM imports, reflecting relatively balanced and mature supply chains in advanced economies. India, however, shows a sharply different pattern: the share of advanced ceramics in AIM imports rises from about 0.08% in 2015 to over 0.20% by 2023–24, while the corresponding export share declines. This divergence suggests that although demand from AIM sectors is increasing rapidly, domestic supply of advanced ceramics has not kept pace, resulting in a growing reliance on imports. Advanced

[12] India's bioceramic industry is transitioning from being a major importer to an indigenous manufacturing hub.
[13] Importer–Exporter Code (IEC) is a unique firm-level registration number issued by DGFT, required for entities engaged in international trade in India. Used here as a proxy for the depth and structure of sectoral trade ecosystems.
[14] It represents technology-centric manufacturing sectors in which advanced ceramics serve enabling functions for thermal/electrical performance, and precision engineering. Considering HS-(37,68,70,84,85,86,87,88,89,90,91,93,95,97)

ceramics are thus becoming increasingly critical for India's industrial upgrading, primarily as imported inputs, underscoring the need to strengthen domestic capabilities in high-value ceramic manufacturing.

Figure-4: Share of Advanced Ceramics in AIM Trade (%)



Source: ITC TradeMap

3. India's Production Landscape: Evidence from Annual Survey of Industries (ASI)

Evidence from the ASI suggests that India's advanced ceramics industry has expanded steadily in scale, likely supported by rising demand from electronics, medical devices, and aerospace applications. Trends in output and sales indicate an increase in reported production activity over time (Table 2)[15]. However, this expansion does not appear uniform, with periods of expansion interspersed with slowdowns. Such variation may be associated with changes in input prices, cost pressures, and broader macroeconomic conditions.

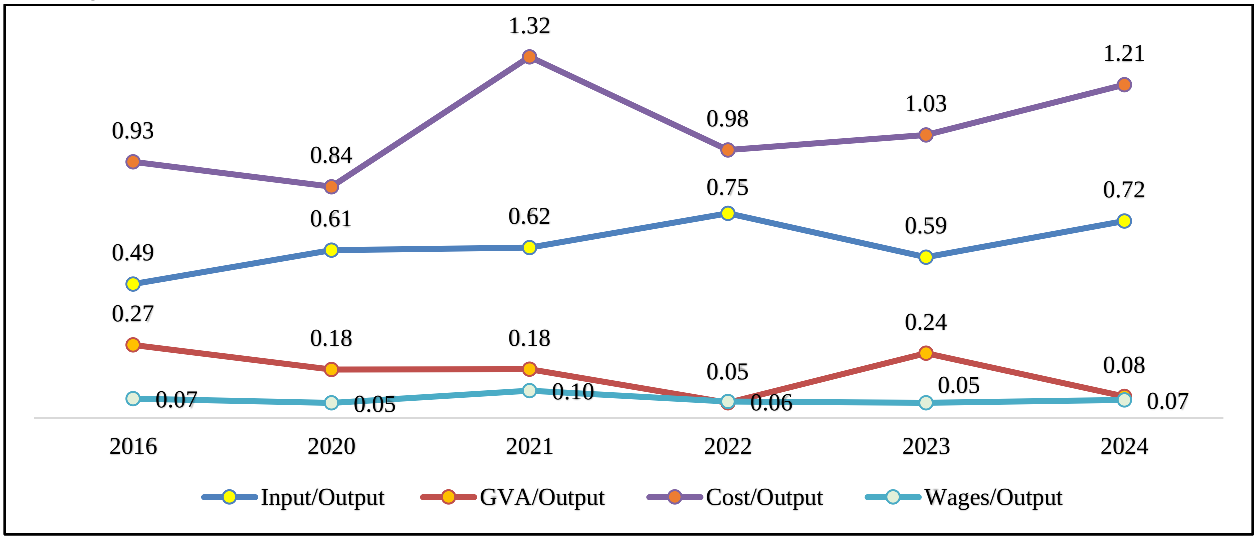
Figure 5 provides descriptive evidence on the production structure of the sector. The input-to-output and cost-to-output ratios remain persistently high and move closely with output, suggesting that higher production has largely been driven by increased material use rather than consistent improvements in efficiency. Gross value added (GVA) exhibits noticeable fluctuations over time, indicating variability in value addition relative to output across years. The wages-to-output ratio

[15] All figures are derived from the Annual Survey of Industries (ASI). Industry totals are estimated by applying a design-based multiplier to each surveyed factory unit (DSL). Depending on its multiplier value, a single surveyed DSL represents a larger number of similar units in the population. Financial indicators (inputs, wages, costs) are traced from the total reported activity of these DSLs, which are identified as ceramic manufacturers via product codes (NPCMS) but may be multi-product establishments. Therefore, while trends are indicative of sector performance, absolute cost levels reflect overall factory operations and may overstate those specific to ceramic production.

remains low and relatively stable, suggesting that labour compensation constitutes a small and largely unchanged share of output, consistent with a production structure that is more capital- and material-intensive.

Overall, ASI evidence suggests that while India's advanced ceramics industry has expanded in scale, this growth has not consistently translated into efficiency gains or stable value addition. High material intensity, volatile GVA, and limited cost efficiency indicate that scale-led expansion alone is insufficient. A shift toward process innovation, yield improvement, and higher-value product segments is therefore essential for long-term competitiveness.

Figure-5: India's Advanced Ceramics: Value Addition, Inputs, and Cost Efficiency (ASI 2016-2024)

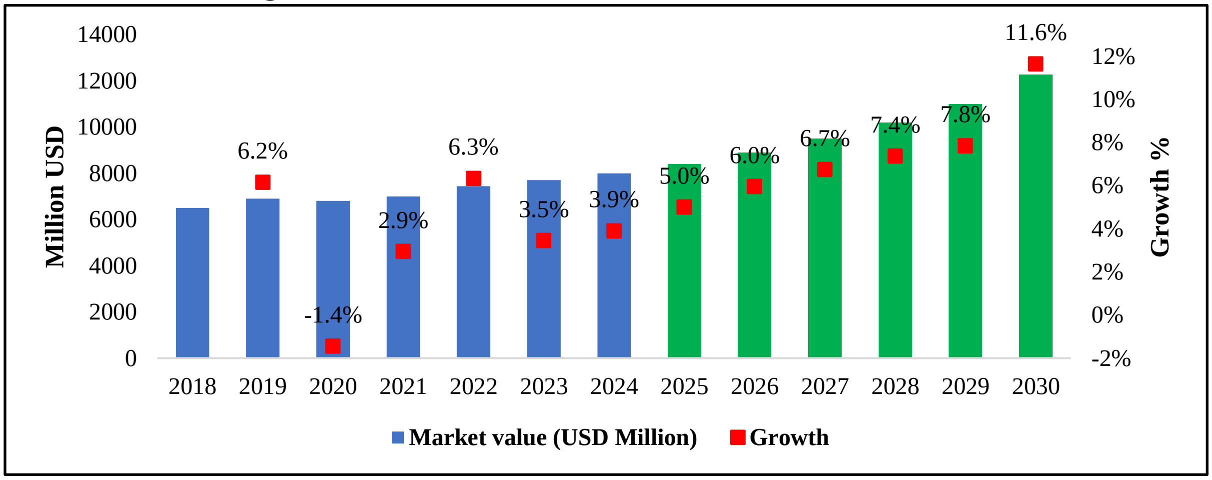


Source: ASI

4. India's Strategic Position in the Global Advanced Ceramics Value Chain

Analysis of trade and production data demonstrates that India is rapidly emerging as one of the fastest-growing markets for advanced ceramics and is expected to reach a projected revenue of US$ 12,280 million by 2030. A CAGR of 6.5% is expected of India advanced ceramics market from 2023 to 2030 (Figure 6).

Figure-6: Growth of Advanced Ceramics Market of India[16]



Source: Grand View Horizon

This rapid market expansion is being driven not by a single end-use, but by rising demand across multiple technology-intensive sectors, each with distinct material and performance requirements for advanced ceramics. The key end-use segments are discussed below:

4.1 Electronics & Semiconductors: The Core Demand Engine

Electronics and semiconductors account for the largest share of global advanced ceramics demand (≈40–45%)[17], driven by the need for substrates, chip packaging, insulation, and thermal management. India's electronics manufacturing growth—from USD 75 billion in 2020 to a projected USD 300 billion by 2026[18]—has sharply increased imports of Al_2O_3 and AlN substrates, SiC components, and packaging materials. Despite PLI support, domestic capabilities in high-purity powders and semiconductor-grade precision ceramics remain limited, making electronics the most strategic driver of India's advanced ceramics import dependence.

4.2 Electric Mobility & Automotive: The Fastest-Growing Segment

The EV transition is rapidly increasing India's demand for advanced ceramics used in power electronics, inverter substrates (AlN, Al_2O_3), bearings, sensors, and thermal insulation. With global EV-related ceramics demand growing at over 10% annually, India mirrors this trend as its EV market expands from USD 3.2 billion in 2023 to over USD 20 billion by 2030[19]. As OEMs such as Tata Motors, Mahindra, and Ola Electric localize EV powertrains, EVs will become a major

16 https://www.grandviewresearch.com/horizon/outlook/advanced-ceramics-market/india
17 https://www.mycii.in/KmResourceApplication/79885.CIIReportonAdvancedMaterialsCriticalMineralsandMetals.pdf
18 https://www.pib.gov.in/PressReleasePage.aspx?PRID=1792189&reg=3&lang=2#:~:text=The%20US$300%20billion%20electronics,and%20ease%20of%20doing%20business.
19 https://www.grantthornton.in/insights/articles/from-imports-to-made-in-india-why-localising-ev-manufacturing-is-key/#:~:text=Additionally%2C%20there%20is%20a%20limited,it%20harder%20to%20achieve%20scale.

volume driver of advanced ceramics consumption, particularly for high-thermal-conductivity components.

4.3 Medical Devices & Healthcare: A High-Value Export Opportunity

Medical and dental applications account for 10–12% of global advanced ceramics demand, led by zirconia implants, orthopedic components, and biocompatible coatings. India's medical devices market is expanding rapidly—from USD 12 billion in 2023 to a projected USD 50 billion by 2032—while shifting toward higher-value implantable devices[20]. Although India exports mid-tech zirconia products (e.g., dental ceramics from clusters like Kerala and Gujarat)[21], it remains import-dependent for high-grade stabilized zirconia and precision medical ceramics, making this a high-margin niche for building export competitiveness as healthcare demand and MedTech incentives grow.

4.4 Aerospace & Defence: A Strategic, Technology-Intensive Driver

Aerospace and defence account for 8–10% of global advanced ceramics demand and involve the most technology-intensive applications. India's rising defence and space spending—from USD 27 billion in 2023 to USD 48 billion by 2032[22]—has increased demand from agencies such as ISRO, DRDO, HAL, and BEL, much of which is still met through imports due to limited domestic capability in non-oxide ceramics and hot isostatic pressing (HIP). As indigenization accelerates under Make in India for Defence and the Indian Space Policy 2023, advanced ceramics emerge as a critical material for strategic self-reliance.

4.5 Renewable Energy & Hydrogen Systems: A Policy-Led Growth Driver

Renewable energy and hydrogen technologies are emerging as a major future demand driver for advanced ceramics. Solid oxide fuel cells (SOFCs), hydrogen electrolysers, solar inverters, wind turbines, and next-generation grid systems rely on ceramics such as yttria-stabilised zirconia, alumina substrates, and corrosion-resistant silicon carbide. India's push under the National Green Hydrogen Mission, domestic solar PV manufacturing, and fuel-cell R&D is therefore creating a growing pull for high-performance ceramic materials. While demand is currently nascent, scale-up over the next decade could significantly raise requirements for advanced ceramic components, particularly in energy conversion and storage applications.

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[20] https://www.ey.com/en_in/insights/health/india-s-medtech-transformation-paving-the-path-to-global-leadership#:~:text=India's%20MedTech%20Industry-,Read%20More%20Read%20Less,global%20leader%20in%20the%20sector.

[21] Dental Bioceramics major companies include Jyoti Ceramic (Nashik), Prevent DenPro (Jammu) and Dorthom Medidents (Coimbatore)

[22] https://invest.up.gov.in/wp-content/uploads/2025/03/1-India_200325.pdf

4.6 Industrial Systems & Heavy Machinery: A Stable Demand Anchor

Industrial systems provide a steady and diversified demand base for advanced ceramics. Sectors such as steel, cement, petrochemicals, chemicals, and precision manufacturing use ceramic bearings, seals, liners, and wear-resistant components to improve efficiency, durability, and corrosion resistance. Unlike mission-driven sectors, industrial demand is driven by lifecycle cost savings and reliability, offering a stable anchor for domestic advanced ceramics manufacturing and an important pathway for gradual capability building and scale.

5. Policy Implications

India's demand for advanced ceramics is rising rapidly across semiconductors, electric mobility, aerospace and defence, medical devices, and clean energy, while domestic production remains concentrated in low- and mid-technology segments. Heavy reliance on imports for high-purity powders, semiconductor-grade substrates, armour ceramics, and precision components constitutes a strategic vulnerability. Addressing this gap requires a coordinated national strategy focused on upgrading mid-stream manufacturing capabilities. Policy intervention must therefore focus not on protecting demand, but on enabling production capabilities in the most value-creating stages of the advanced ceramics value chain.

- **Anchor domestic capability in mid-stream process technologies:** India's primary constraint lies in high-purity powder processing, advanced sintering (including HIP), precision machining, and functional integration. A dedicated Advanced Materials Production Mission, aligned with the India Semiconductor Mission and defence manufacturing programs, should support pilot-scale facilities, shared HIP infrastructure, and applied process R&D. Public institutions such as CSIR–CGCRI (Central Glass and Ceramic Research Institute) already provide a strong foundation, with recent breakthroughs in transparent ceramics demonstrating the feasibility of domestic innovation.

- **Use trade policy to unlock technology:** India's experience suggests that tariffs are not the binding constraint in advanced ceramics. Import growth has been strongest in technology-intensive applications—such as electronics, EVs, defence, and medical devices—and spans a wide range of supplier countries, including Japan, South Korea, the United States, Germany, China, and Indonesia. Despite this variation in tariff treatment—ranging from zero duty under FTAs with Japan and South Korea to high MFN tariffs of 8.3–11% for other suppliers—India's import dependence has continued to rise across all partners. This indicates that imports are driven by capability gaps rather than tariff incentives. In the short run, rising imports have enabled access to high-performance materials essential for downstream industries. However, without parallel development of domestic processing and manufacturing capabilities, this trend may risk locking India into long-term import dependence. Trade policy should therefore shift from tariff calibration toward capability-linked measures, including technology partnerships, joint manufacturing, and targeted investment in domestic production infrastructure, to translate import-led efficiency gains into indigenous manufacturing capacity.

- **Scale bioceramics through translational manufacturing pathways:** India has credible strengths in medical ceramics that can be industrialized. Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST)'s hydroxyapatite-based bone graft technology and emerging startups such as Medicad Implants, working with CSIR–CECRI on AI-enabled, patient-specific ceramic implants, demonstrate a viable pathway from public research to high-value bioceramics manufacturing.

- **Lower entry barriers through shared infrastructure and technology transfer:** Capital intensity remains a key barrier. Shared facilities for advanced sintering, precision machining, additive manufacturing, and accredited testing—combined with institutionalized technology-transfer mechanisms from CSIR labs, DRDO, ISRO, and BARC—can accelerate private-sector participation. Technology Development Board initiatives in ceramic and metal 3D printing offer a fast-track route for capability building.

- **Align incentives with mission-led demand creation:** A dedicated PLI-type framework for advanced ceramics, distinct from traditional ceramics, should target electronic ceramics, bioceramics, armour ceramics, and energy applications. Embedding advanced ceramics into localisation and procurement roadmaps under EV, semiconductor, hydrogen, defence, and MedTech missions can create stable demand signals. Targeted global partnerships with Japan, the United States, Germany, and Korea can facilitate access to process know-how, while securing inputs such as yttria, zirconium compounds, and high-purity alumina will reduce supply-chain risks.

5.1 Way Forward

India's transition to indigenous advanced ceramics capability hinges on targeted upgrading of mid-stream process technologies. By combining public R&D strengths, focused capacity creation, precision manufacturing infrastructure, mission-linked demand, and global technology partnerships, India can move from demand-led import dependence toward domestically anchored, high-value advanced ceramics manufacturing—strengthening industrial competitiveness and technological resilience across critical sectors.

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Annex

Definition of NPCMS codes

National Product Classification for Manufacturing Sector (NPCMS), 2011 has been constructed by CSO, IS Wing, Kolkata, based on Sections 0 to 4 of CPC, Ver. 2 that relate to products of the manufacturing sector. NPCMS, 2011 is a 7-digit classification and the structure is: 5-digit CPC Code + 2-digit Indian requirement. With 5 Sections, 40 Divisions, 190 Groups, 785 Classes and 1501 Sub-Classes = ultimately 7-digit products. From ASI 2010-2011 onwards, the 7-digit code and its description as per NPCMS, 2011 will be used for collecting and recording of all input and output items in ASI schedule.

The mapping from HS to CPC to NCPMS used to identify advanced ceramics manufacturers in the ASI database is an indicative concordance, as no direct one-to-one link exists between trade and industrial classifications. For HS codes with mixed product coverage, only laboratory, chemical, industrial, and engineered ceramic applications are classified as advanced ceramics, while bulk and construction-grade products are excluded, making the estimates conservative.

Table 1: Concordance from HS to NPCMS

HS Code	Description (Pure Advanced Ceramics)	Correct NPCMS Code(s)	Rationale
690911	Ceramic wares for laboratory, chemical or industrial use (porcelain/china)	**3729100**	Pure technical ceramics; perfect match with industrial/technical ceramics classification.
690912	Laboratory/chemical ceramic wares of refractory composition	**3729100**	Still technical ceramics; excludes bulk construction refractories.
690919	Other ceramic wares for laboratory, chemical or industrial use	**3729100**, **3732099**	Captures both technical ceramics and engineered industrial ceramic parts; requires careful filtering in ASI.
690990	Other ceramic wares for industrial use (technical ceramics)	**3732099**	Strongest match for engineered ceramics such as zirconia parts, SiC components, precision industrial ceramics.
690390	Other refractory ceramic goods (engineered subset only)	**3732002**	Only high-performance engineered refractories are included; bulk/low-tech refractories excluded.

Table-2: India's Advanced Ceramics: Industry Scale and Cost Structure (2016–2024)

Key Parameters	2016	2020	2021	2022	2023	2024
Total Output	122	231	152	179	182	206
Exfactory_output	92	182	121	143	150	164
Inputs	60	141	94	133	107	148
GVA	32	41	27	10	43	16
Gross Sales	103	190	134	162	167	174
Production Cost	114	195	200	174	188	250
Wages & Salaries	9	13	15	11	10	13
Workdays (per unit)	283	279	246	286	300	297
N (surveyed units)	79	68	77	74	81	75
Real units *	336	279	357	342	505	403

Note: Values reported are annual averages. Output, input usage, GVA, gross sales, wages and salaries, and cost of production are expressed in INR million. Average employment and work days are reported in number of persons and number of days, respectively. * Real units are estimated by multiplying the number of surveyed units (N) by the corresponding multiplier.

Source: Annual Survey of Industries (ASI).

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ABOUT THE CENTRE

About CRIT

India's Foreign Trade Policy (FTP) Statement 2015-20 suggested a need to create an institution at the global level that can provide a counter-narrative on key trade and investment issues from the perspective of developing countries like India. To fill this vacuum, a new institute, namely the Centre for Research on International Trade (CRIT), was set up in 2016. The vision and the objective of the CRIT were to significantly deepen existing research capabilities and widen them to encompass new and specialized areas amidst the growing complexity of the process of globalization and its spill-over effects in domestic policymaking. Secondly, enhancing the capacity of government officers and other stakeholders in India and other developing countries to deepen their understanding of trade and investment agreements.

About CWS

The Centre for WTO Studies which is a constituent Centre of CRIT, pre-dates the CRIT since it was created in 1999 to be a permanent repository of WTO negotiations-related knowledge and documentation. Over the years, the Centre has conducted a robust research program with a series of papers in all spheres of interest at the WTO. It has been regularly called upon by the Government of India to undertake research and provide independent analytical inputs to help it develop positions in its various trade negotiations, both at the WTO and other forums such as Free and Preferential Trade Agreements and Comprehensive Economic Cooperation Agreements. Additionally, the Centre has been actively interfacing with industry and Government units as well as other stakeholders through its Outreach and capacity-building programs by organizing seminars, workshops, subject-specific meetings, etc. The Centre thus also acts as a platform for consensus building between stakeholders and policymakers. Furthermore, the inputs of the Centre have been sought after by various international institutions to conduct training and studies.

CENTRE FOR WTO STUDIES

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