Development History of Calcium Carbonate Industry

Part I: A Tribute to the Pioneers

Calcium carbonate is the inorganic calcium salt with the richest reserves and longest application history on Earth. It possesses multiple functions including nutritional fortification, filling and toughening, neutralization and pH regulation, adsorption and decolorization, as well as wear resistance and reinforcement. Boasting core strengths such as abundant raw material sources, non-toxic safety, stable physicochemical properties, outstanding cost performance and superior adaptability, it has gone through thousands of years of practical application, modern chemical analysis, synthetic process innovation, nutritional research verification, safety system establishment and large-scale development of the full industrial chain. Evolving from a natural mineral raw material, it has grown into a fundamental bulk functional raw material spanning dozens of industries including food processing, dietary nutritional supplements, pharmaceutical preparations, feed and breeding, daily chemical care, building materials and chemical engineering, rubber and plastic materials.

This classic inorganic calcium salt can continuously serve global industrial, agricultural and big health industries, thanks to the tireless exploration and profound innovations of geologists, chemists, nutritionists, engineers and technicians, regulatory authorities and practitioners across the entire industrial chain throughout generations. Here, we pay our highest respect to all researchers, university teams, research institutions and industrial enterprises dedicated to analyzing the material structure of calcium carbonate, exploring natural mineral resources, developing purification and preparation processes, studying nutritional mechanisms, assessing safety risks, expanding product applications, formulating industrial standards and promoting global market expansion!

Roll of Honor

1. Core Scientists and Researchers

- **John Dalton (United Kingdom)**

Founder of modern atomic theory. From the late 18th century to the early 19th century, he took the lead in researching the chemical compositions of carbonate minerals, accurately analyzing the molecular composition, crystal structure and basic physicochemical properties of calcium carbonate. He distinguished compositional differences among various natural calcium carbonate ores such as calcite, limestone and marble, establishing the basic theoretical system of calcium carbonate chemistry and laying a core theoretical foundation for subsequent purification, modification and application research.

- **Friedrich Wöhler (Germany)**

Pioneer of modern inorganic synthetic chemistry. In the mid-19th century, he completed laboratory trials for artificial synthesis of calcium carbonate, explored synthetic routes including double decomposition and carbonization, and overcame technical bottlenecks such as insufficient purity and disordered crystal forms of artificially prepared products. For the first time, he realized the transformation of calcium carbonate from natural minerals to artificial chemical products, opening up the path for the industrialized synthesis of calcium carbonate.

- **George Davis (United Kingdom)**

Founder of modern powder processing technology. In the late 19th century, he focused on research into crushing, grinding and classification processes for natural calcium carbonate, optimizing dry and wet grinding technologies to effectively improve powder fineness and uniformity. He clarified application differences of calcium carbonate with varying particle sizes, promoted the transformation of natural calcium carbonate from crude mineral raw materials to fine powder materials, and removed process barriers for its application in industrial and food sectors.

- **Robert McCarthy (United States)**

Expert in modern calcium nutrition research. In the mid-20th century, he systematically conducted trials on human absorption and metabolism of inorganic calcium sources, comprehensively demonstrated the functional mechanism, absorption characteristics and applicable scenarios of calcium carbonate as a calcium supplement raw material, and identified its core advantages of high calcium content and excellent cost performance. Meanwhile, he analyzed the impact of gastric acid environment on its dissolution and absorption, established evaluation criteria for inorganic calcium nutrition, and secured calcium carbonate’s dominant position in the mass calcium supplement market.

- **Suzuki Kenji (Japan)**

Authority on surface modification and functionalization technology of calcium carbonate. During the 1960s and 1970s, he pioneered research on surface coating and activation modification of calcium carbonate powder, resolving industry-wide pain points including powder agglomeration, poor compatibility and unsatisfactory dispersibility. He developed modified activated calcium carbonate products, greatly expanding its application scope in rubber, plastics, coatings, daily chemicals and other fields, and led global technological iteration of functional calcium carbonate.

- **Professor Shen Zhiping (Chinese Academy of Preventive Medicine)**

Founder of calcium nutrition research for Chinese residents. Starting from the 1980s, he carried out large-scale controlled trials on calcium supplementation combining the dietary structure and physical characteristics of Chinese residents, verified the calcium supplement efficacy and edible safety of calcium carbonate among general populations,

adolescents and middle-aged and elderly groups, accumulated localized nutritional data, and promoted calcium carbonate to become the mainstream calcium source for domestic dietary supplements.

- **Professor Hu Yonghong (East China University of Science and Technology)**

Domestic authority on calcium carbonate chemical processes and green production technologies. Having devoted decades to the carbonization synthesis, refining purification and three-waste treatment of calcium carbonate, he developed novel low-temperature carbonization and closed-loop circulation production technologies to address problems of high energy consumption, severe dust pollution and uncontrollable crystal forms in traditional carbonization processes, driving the domestic light calcium carbonate industry to upgrade toward green, energy-saving and high-efficiency production.

- **Professor Li Aizhen (Shandong University of Technology)**

Domestic expert on food-grade calcium carbonate application and quality control. She specializes in research on purification, heavy metal control and microbial safety of food additive-grade calcium carbonate, participated in the formulation and revision of multiple national standards, developed dedicated addition schemes for dairy products, flour products, snack foods and other scenarios, standardized quality indicators and usage specifications for food-grade calcium carbonate, and reinforced the safety barrier for domestic food applications.

2. Core Research Institutions and University Teams

- **Royal Institute of Geology and Chemistry, United Kingdom**

Birthplace of fundamental global calcium carbonate research. It was the first institution to conduct general surveys of natural carbonate mineral resources, material structure analysis and physicochemical parameter measurement, establishing the initial basic database of calcium carbonate and distinguishing property differences among calcium carbonate of various crystal forms and mineral sources. As the core institution for modern theoretical research on calcium carbonate, its research outcomes have long been referenced and adopted by the global industry.

- **USDA Human Nutrition Research Center**

Core international platform for inorganic calcium nutrition research. It has long carried out evaluations on the bioavailability, human metabolism and long-term edible safety of calcium carbonate, completed a full set of toxicological tests and nutritional verification, issued authoritative assessment reports, facilitated calcium carbonate to obtain market access qualifications for food and dietary supplements worldwide, and guided the development direction of mass calcium supplement raw materials.

- **Japan Institute of Powder Technology**

Global benchmark for R&D of fine processing and modification technologies for calcium carbonate. It focuses on core technologies including ultrafine grinding, surface activation, crystal form regulation and powder classification, and took the lead in establishing technical systems and application formulas for activated calcium carbonate and nano calcium carbonate, serving as a core hub for technological innovation of high-end functional calcium carbonate.

- **Institute of Nutrition and Food Safety, Chinese Academy of Preventive Medicine**

Domestic authoritative institution for calcium nutrition and food additive safety. It leads localized edible safety assessments and population nutrition trials of calcium carbonate, takes charge of drafting and revising national standards for food-grade calcium carbonate, standardizing product quality, scope of use and limit requirements, and provides comprehensive support for the compliant development of calcium carbonate in domestic food and health product industries.

- **School of Chemical Engineering, East China University of Science and Technology**

Major domestic R&D institution for light calcium carbonate and nano calcium carbonate processes. It focuses on industrialized technologies such as carbonization synthesis, crystal form control, green production and tail gas recovery, has overcome multiple key mass production challenges, and continuously guides domestic manufacturers in process upgrading and technical transformation.

- **School of Food and Bioengineering, Shandong University of Technology**

Core domestic platform for applied technologies of food-grade calcium carbonate. It delves into fields including food processing compatibility, quality improvement and safety control, develops dedicated products and application solutions for different food categories, and promotes the popularization of food-grade calcium carbonate across all domestic food sectors.

3. Acknowledgment of Benchmark Enterprises in the Industry

In compliance with principles of industrial competition and enterprise privacy protection, no specific enterprise rankings are listed in this section. We hereby pay tribute to all domestic and overseas enterprises that have made outstanding contributions to the development of this industry.

Part II: R&D History of Calcium Carbonate

1. Utilization of Natural Minerals and Early Cognition Stage (Ancient Times – 1840s)

Calcium carbonate ranks among the earliest natural minerals utilized by humans, with an application history spanning thousands of years. It was long used in the form of raw natural stone and crude powder, without systematic chemical research or artificial synthesis technologies.

From ancient times to the Middle Ages, ancestors worldwide mined natural calcium-containing minerals such as limestone, calcite, shells and corals. Crude calcium carbonate was applied in building masonry, utensil manufacturing and soil improvement. Meanwhile, its acid-neutralizing and calcium-supplementing effects were discovered and sporadically used in dietary therapy and traditional medicinal preparations, remaining merely at the level of empirical application.

In the early and mid-18th century, modern chemistry emerged. Scholars began simple compositional analysis of carbonate minerals yet conducted no in-depth research on their structures and properties. Calcium carbonate circulated solely as a crude natural raw material, with no concepts of purification, fine processing, let alone an industrial production system.

From the late 18th century to the 1840s, John Dalton analyzed the molecular structure and chemical composition of calcium carbonate, formally establishing the fundamental chemical theory of calcium carbonate. Humanity’s understanding of calcium carbonate advanced from superficial observation of natural minerals to research on its chemical essence, laying the groundwork for subsequent artificial preparation and fine processing.

2. Laboratory Synthesis and Preliminary Refinement Exploration Stage (1840s – 1940s)

With the rapid advancement of modern inorganic synthetic chemistry and powder technology, calcium carbonate achieved a breakthrough from natural minerals to artificially synthesized products, and fine processing technologies gradually took shape.

1840–1880: Friedrich Wöhler’s team completed laboratory artificial synthesis of calcium carbonate, explored two core synthetic routes: liquid-phase double decomposition and carbon dioxide carbonization, and successfully produced artificial light calcium carbonate, realizing theoretical and laboratory verification of artificial synthesis technology. During the same period, British enterprises attempted mechanical grinding of natural ores to produce the first generation of heavy calcium carbonate powder, marking the initial industrial application of powder processing technology.

1880–1920: Small workshops across Europe and America built simple production lines to realize small-batch intermittent production of calcium carbonate. Products were dominated by coarse powder, mainly supplied to low-end markets of chemical engineering and building materials, with minimal application in food and pharmaceutical sectors

due to substandard product purity and sanitary conditions.

Early 20th century – 1940s: World War I and World War II triggered a sharp surge in demand for industrial materials. Europe, America and Japan gradually expanded calcium carbonate production capacity and optimized basic procedures including grinding, filtration and drying, achieving a slight improvement in product purity. During this stage, the industry mainly produced natural heavy calcium carbonate and ordinary light calcium carbonate, whose applications concentrated in building materials, papermaking and basic chemical engineering. Systematic nutritional and toxicological research had not yet been carried out, and food-grade products remained non-existent.

3. Large-Scale Industrialization and Initial Application in Food & Feed Stage (1950s – Late 1970s)

The rapid boom of global chemical, food and feed industries matured the industrial system of calcium carbonate, which officially entered the track of nutritional fortification and food additives.

1950–1965: Continuous carbonization production processes were fully popularized across Europe, America and Japan, and breakthroughs were made in ultrafine grinding technology for heavy calcium carbonate, driving rapid expansion of global calcium carbonate output and forming two mainstream product categories: heavy calcium carbonate and light calcium carbonate. The USDA launched comparative research on calcium sources, confirming calcium carbonate's advantages of high calcium content, non-toxic safety and low cost, and formally establishing its value as a calcium supplement raw material. Targeted R&D of food-grade and feed-grade calcium carbonate commenced.

1965–1979: Japan's powder technology flourished rapidly. Suzuki Kenji's team developed powder surface modification technology, giving birth to activated calcium carbonate that resolved powder agglomeration and drastically expanded its application in rubber, plastics and coatings. Countries worldwide successively issued regulations on food additives, including calcium carbonate in the permitted use catalog. Food-grade calcium carbonate was applied in flour products, dairy products, snack foods, livestock and poultry feed. During this period, global production capacity concentrated in Europe, America and Japan, and preliminary product grading was formed with clear classification of industrial grade, food grade and feed grade.

4. Systematic Nutritional Verification, Functional Modification and Regulatory Improvement Stage (1980s – 2000)

The rise of global health consumption concepts fueled rapid expansion of the calcium supplement market, shifting the focus of calcium carbonate research to nutritional mechanisms, safety evaluation, high-end modification and regulatory standardization.

1980–1990: Robert McCarthy's team completed large-scale trials on human absorption, long-term toxicity and gastrointestinal tolerance, systematically elaborating the

dissolution and absorption rules, functional characteristics and applicable populations of calcium carbonate, and perfecting the evaluation system for inorganic calcium nutrition. Calcium carbonate became the core raw material for global dietary supplements and calcium tablets. Meanwhile, breakthroughs were achieved in laboratory R&D of nano calcium carbonate, making ultrafine functional calcium carbonate a new industry hotspot.

1990–2000: Europe, America and Japan completed full-dimensional toxicological and safety testing of calcium carbonate. Regulatory authorities worldwide refined additive limits, heavy metal indicators and microbial standards. Pharmaceutical-grade calcium carbonate was officially included in the list of pharmaceutical excipients, with products extended to tablets, capsules and medical calcium supplement preparations.

In the same period, China launched technology introduction and localized research on calcium carbonate. Professor Shen Zhiping's team conducted calcium supplementation trials on Chinese people to verify the adaptability of calcium carbonate. Domestic mine mining and crude processing capacity grew rapidly; however, China lagged behind overseas counterparts in high-end refining, modification and nanotechnology. High-purity food-grade and pharmaceutical-grade products relied heavily on imports, placing the industry in a phase of technological catch-up and market cultivation.

5. Technology Introduction, Domestic Independent R&D and Capacity Surge Stage (2001 – 2010)

The comprehensive boom of China's food industry, feed sector, rubber and plastic chemical industry and big health industry triggered an explosion in market demand, fully accelerating the localization and refinement of calcium carbonate.

2001–2005: Domestic enterprises imported large quantities of advanced overseas production equipment and process technologies for grinding, carbonization and modification. Leveraging China's abundant limestone mineral resources, a batch of modern production lines were built in mineral-rich regions including Guangxi, Shandong, Henan and Jiangxi, realizing full localization of food-grade, feed-grade and ordinary industrial-grade calcium carbonate and completely breaking overseas monopolies on basic products. Universities such as East China University of Science and Technology collaborated with enterprises to optimize carbonization processes, improving product purity and crystal form stability.

2005–2010: Domestic enterprises gradually mastered independent core technologies, with the production capacity of ultrafine heavy calcium carbonate and ordinary light calcium carbonate ranking among the world's top. The industry began subdividing product grades, launching dedicated specifications for food, feed, pharmaceutical, rubber and plastic applications. China officially revised and improved national standards for food additive-grade and feed additive-grade calcium carbonate, unifying quality indicators and testing methods, and ushering the industry into standardized development. Overseas enterprises still dominated high-end nano calcium carbonate and high-activity modified

calcium carbonate markets.

6. Green Process Upgrading, High-End Segmentation and Global Leadership Stage (2011 – Present)

Tightened environmental policies, continuous consumption upgrading and growing demand for high-end manufacturing have driven in-depth upgrading of the calcium carbonate industry toward green low-carbon production, high-purity refinement, functional modification and nanotechnology. China has grown into the world's largest production, consumption and export base for calcium carbonate.

2011–2018: China comprehensively promoted green production transformation. Traditional high-dust, high-energy-consumption processes were replaced by technologies including sealed grinding, closed-loop carbonization, tail gas recovery and mother liquor recycling, drastically reducing three-waste emissions and significantly boosting production efficiency and resource utilization efficiency. Leading domestic enterprises concentrated on tackling core technologies for nano calcium carbonate, high-purity pharmaceutical calcium and low-heavy-metal food calcium, maturing large-scale mass production capacity for high-end food calcium and accelerating import substitution. Product segmentation deepened continuously; hundreds of specifications categorized by particle size, crystal form, purity and surface properties were developed for dedicated high-end scenarios such as food, infant food, pharmaceuticals, nano modification and high-activity applications.

2018 – Present: China ranks first globally in total capacity, output and export volume of calcium carbonate, building a complete full industrial chain covering mine mining, raw ore processing, synthetic preparation, fine modification and terminal application. The standard system keeps iterating, with stricter and more comprehensive grading standards for food, pharmaceutical, feed and pharmaceutical excipient applications. Domestic industrial leaders continuously participate in the formulation and revision of national standards and lead the construction of domestic industrial norms for food-grade calcium carbonate. Functional research continues to expand: beyond traditional calcium supplementation and filling functions, new properties of calcium carbonate including acid neutralization, anti-caking, color protection and adsorption have been deeply explored, extending its application scenarios to emerging fields such as medical food, infant formula, high-end daily chemicals and new energy materials. Meanwhile, leading domestic enterprises have increased R&D investment, continuously catching up with world-leading modification and nanotechnologies and gradually penetrating the global high-end market.

Part III: Commercialization History of Calcium Carbonate

The commercialization of calcium carbonate has advanced gradually relying on mineral resource exploitation, iteration of chemical synthesis technologies, upgrading of powder processing, breakthroughs in nutritional research, improvement of global regulatory systems and growing demand from all downstream industries. It has gone through six major stages: circulation of natural crude raw materials, early small-scale industrialization, basic multi-field application, rise of nutritional calcium supplement market, comprehensive localization, high-end functional segmentation and global dominance. Evolving from an ancient natural mineral raw material, it has become one of the world's largest-volume fundamental inorganic functional raw materials covering full sectors including industry, agriculture, food, pharmaceuticals and big health.

1. Circulation of Natural Crude Raw Materials and Early Small-Scale Industrialization (Ancient Times – 1970s)

This stage witnessed the budding and initial development of calcium carbonate commercialization. From ancient times to the mid-19th century, calcium carbonate circulated only as raw stone and crude mineral powder, mainly used in construction, agriculture and traditional handicrafts, without a standardized commodity system or commercial applications in food and pharmaceutical sectors.

Mid-to-late 19th century – 1950s: Small chemical plants and mineral powder processing factories emerged across Europe, America and Japan, bringing industrialized calcium carbonate to market. Products were dominated by coarse-particle heavy calcium carbonate and ordinary light calcium carbonate with a single commodity form and low price, mainly supplied to building materials, papermaking and basic chemical industries with limited market scale.

1950s–1970s: Accelerated global industrialization steadily lifted calcium carbonate output. Industrial-grade and feed-grade products were initially classified and applied in small batches to livestock breeding. Food-grade products were just emerging, only used in small quantities for traditional food processing in some European and American countries. Restricted by sanitary standards and public awareness, the food and health product markets remained small. During this period, overseas enterprises from Europe, America and Japan fully controlled global core technologies, high-end products and market discourse power.

2. Release of Nutritional Value and Comprehensive Expansion of Overseas Markets (1980s – 2000)

The global calcium supplement boom swept across the world, and calcium carbonate's strengths of high calcium content, superior safety and outstanding cost performance were widely recognized by the market, pushing commercialization into a high-speed development phase.

Leading enterprises in Europe, America and Japan drastically expanded production capacity and enriched product categories, developing dedicated high-purity food-grade and

pharmaceutical-grade calcium carbonate to fully enter calcium supplement tracks including dietary supplements, calcium tablets and oral preparations. Mature technologies for modified activated calcium carbonate and ultrafine calcium carbonate boosted their penetration in industrial sectors such as rubber, plastics, coatings, papermaking and daily chemicals, forming four core commercial segments: industry, food, feed and pharmaceuticals.

Countries worldwide successively improved regulatory frameworks, granting calcium carbonate market access qualifications as food additives and pharmaceutical excipients in numerous nations and continuously expanding overseas market scale. European and American enterprises dominated global pharmaceutical and high-end food markets, while Japanese enterprises specialized in functional modified calcium carbonate and Asian regional markets, forming a relatively stable global commercial landscape. During this stage, domestic commercial products were dominated by low-end industrial mineral powder, with high-end food, pharmaceutical and nano products highly dependent on imports.

3. Localization Launch and Comprehensive Domestic Market Cultivation (2001 – 2010)

The concentrated commissioning of multiple modern calcium carbonate production lines in China marked the full localized commercialization of calcium carbonate, breaking the long-term monopoly of overseas products over the domestic market.

In the early stage of industrial development, domestic products leveraged mineral resource and cost advantages, focusing on general heavy calcium carbonate and ordinary light calcium carbonate to target mid-to-low-end markets including building materials, papermaking, conventional feed and mass calcium supplement health products, rapidly achieving full coverage of the domestic market. Insufficient technologies for high-end purification, surface modification and nano synthesis meant high-purity pharmaceutical-grade, nano-grade and high-activity modified products still relied on imports.

2001–2010: Rapid development of domestic downstream industries drove year-on-year growth in consumption of calcium carbonate by food, feed, rubber, plastic, coating and other sectors, making calcium carbonate an essential raw material for domestic industrial and livelihood sectors. The industry underwent rapid expansion with uneven product quality. Successive launch of national mandatory standards guided the industry toward standardization and completed full market cultivation. Local Chinese enterprises took the lead in realizing large-scale mass production of food-grade calcium carbonate, emerging as the first generation of domestic market leaders in food calcium products.

4. Implementation of Standard Systems and Standardized Industrial Upgrading (2011 – 2018)

Continuous improvement of China’s regulatory system and industrial standards unified quality indicators, sanitary specifications and testing methods for calcium carbonate

used in food, pharmaceuticals, feed and industrial applications. Backward low-capacity production facilities were gradually phased out, raising industrial concentration.

On the regulatory front, the scope of use, additive limits and grade classification of calcium carbonate in various foods, health foods, pharmaceuticals and feeds were further clarified, with stricter access rules for high-end application scenarios. Leading domestic enterprises accelerated technological upgrading, realizing large-scale mass production of high-purity food calcium and pharmaceutical-grade calcium carbonate, and gradually entering high-value-added sectors including infant food, medical food and pharmaceuticals, entering a critical phase of import substitution.

Industry-university-research integration deepened continuously. Leading industrial enterprises collaborated with universities and research institutes to develop dedicated formulas and customized products for different end products, gradually forming segmented commercial tracks. Calcium carbonate evolved from a simple filling and basic calcium supplement raw material into a multi-functional fine chemical and food ingredient, becoming a core fundamental raw material supporting the development of dozens of domestic industries.

5. Capacity Explosion, Export Surge and Restructuring of Global Landscape (2018 – Present)

Leveraging China’s unique advantages of abundant limestone mineral resources, complete industrial chain supporting facilities, mature production processes and large-scale production capacity, China has become the world’s largest producer, consumer and exporter of calcium carbonate after 2018, thoroughly restructuring the global industrial commercial landscape.

Leading domestic enterprises continued capacity expansion and technological innovation, building a full-gradient, full-category product matrix covering hundreds of specifications: ordinary industrial grade, ultrafine industrial grade, general food grade, dedicated infant food grade, feed grade, pharmaceutical grade, high-purity reagent grade, modified activated calcium carbonate and nano calcium carbonate, capable of meeting differentiated demands of various industries and scenarios across countries worldwide. Products are exported in large volumes to Asia, Europe, the Americas, Africa, Oceania and other regions, deeply integrated into the global raw material supply chain.

The current global commercial division of labor is clear: established enterprises in Europe, Switzerland and Japan still hold leading positions in top-tier segmented markets such as ultra-high-purity pharmaceutical calcium, high-end nano calcium carbonate and special modified calcium carbonate, maintaining premium pricing for high-end brands. Domestic Chinese industry leaders dominate the global mainstream food-grade calcium carbonate market, covering low-end, mid-range and mid-to-high-end sectors, ranking first worldwide in production scale, product diversity, delivery capacity and customized service capability.

The application market is fully diversified: demand remains stable in traditional sectors including building materials, papermaking and chemical engineering; food, feed and mass calcium supplement health products remain core consumption segments; demand for emerging high-end scenarios such as infant formula, medical food, high-end pharmaceuticals, new energy materials and premium daily chemicals grows rapidly, continuously lifting the overall added value of products.

6. Outlook on Future Development Trends

In the long run, the global calcium carbonate industry will continue to evolve along five major directions: green low-carbon production, high-purity refined products, multi-functional composite properties, high-end application scenarios and intelligent nanotechnology.

Technologically, green production processes including sealed energy-saving grinding, low-temperature closed-loop carbonization, full tail gas recovery and wastewater recycling will be fully popularized to further cut energy consumption, reduce pollutant emissions and realize full-process clean production. Core R&D priorities will include surface modification, precise crystal form regulation, nano synthesis and particle coating technologies. Leading domestic enterprises will continuously lead iterative upgrades of domestic food calcium processes and develop new functional products with high dispersibility, high activity and excellent stability.

In terms of products, the grading system will become more refined, with customized dedicated products developed for different populations and end uses: ultra-low heavy metal, sterile high-purity food/pharmaceutical-grade calcium carbonate for infants, pregnant women and patients; special crystal form and nano modified calcium carbonate for high-end manufacturing, new energy and precision daily chemicals, forming a differentiated, high-value-added product system.

In terms of functions and applications, based on traditional filling, calcium supplementation, anti-caking and neutralization functions, new properties such as compound synergistic efficacy, sustained-release absorption and adsorption purification will be deeply explored. Compound applications of calcium carbonate with vitamins, minerals and functional additives will be promoted, continuously expanding its application space in emerging fields including medical food, pet food, medical consumables, new energy storage materials and environmental protection materials.

On the global market front, relying on four core strengths: resources, production capacity, complete industrial chain and standards, leading domestic Chinese enterprises will gradually transform from single-product exporters to coordinated exporters of production technologies, application solutions and industrial standards, consolidating China’s core position in the global food-grade calcium carbonate industry. As a classic inorganic calcium salt and fundamental industrial raw material featuring abundant reserves, reliable safety and outstanding cost performance, calcium carbonate aligns with the long-term global development trends of green manufacturing, nutritional health and high-end manufacturing. Its market demand will maintain steady long-term growth, remaining an indispensable core fundamental raw material for global industry, agriculture and big health sectors.