

Global Chips XRD Crystal Analysis Market Growth (Status and Outlook) 2026-2032

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Abstracts

The global Chips XRD Crystal Analysis market size is predicted to grow from US\$ 254 million in 2025 to US\$ 475 million in 2032; it is expected to grow at a CAGR of 9.0% from 2026 to 2032.

Semiconductor XRD crystal analysis is a technology and product system that applies the physical laws of X-ray diffraction from periodic crystal lattices to perform nondestructive measurement and model-based interpretation of the phase, orientation, lattice parameters, strain, composition, layer thickness, crystallinity, texture, and residual stress of semiconductor substrates, epitaxial layers, functional thin films, and packaging materials. Its core value lies in converting atomic arrangements and process variations inside materials into quantifiable structural parameters, thereby supporting quality decisions in crystal growth, wafer slicing and orientation, epitaxy recipe development, front-end wafer fabrication, power and RF compound semiconductors, memory, advanced packaging, and failure analysis. Common technical forms include high-resolution X-ray diffraction, conventional phase analysis, grazing-incidence diffraction, crystal orientation measurement, microbeam diffraction, and multimode measurement combined with X-ray reflectometry. A typical system comprises an X-ray source, precision goniometer, monochromating and collimating optics, sample stage, detector, and fitting software. Delivery models include laboratory R&D instruments, near-fab or at-line metrology tools, automated wafer systems with FOUP or cassette handling and SECS/GEM interfaces, and third-party analytical services charged per sample or project. Major customers include ingot and wafer manufacturers, epitaxial wafer suppliers, foundries, memory and power-device manufacturers, packaging-material companies, universities and research institutes, and professional testing laboratories.

Demand for semiconductor XRD crystal analysis is moving beyond offline validation in

R&D and into high-frequency quality control across wafer manufacturing and materials production. Advanced logic, memory, and compound-semiconductor devices impose increasingly tight tolerances on epitaxial composition, strain, lattice mismatch, layer thickness, crystal orientation, and offcut angle, while electrical end-of-line testing and destructive cross-sectional analysis alone cannot identify front-end material deviations quickly enough. XRD offers nondestructive, repeatable, and direct characterization of lattice structure. It can support phase, crystallinity, texture, and residual-stress research in the laboratory, while automated alignment, wafer mapping, and model fitting enable stable process-monitoring methods. The central change in market demand is therefore not a simple increase in instrument counts, but the conversion of diffraction results into data that can participate in process decisions. Typical tasks include determining whether an epitaxy lot has drifted from target conditions, confirming whether substrate orientation and offcut meet growth requirements, identifying thin-film phase transitions and stress anomalies, and tracking within-wafer and lot-to-lot uniformity. As wafer sizes expand, material systems diversify, and process windows narrow, measurement speed, repeatability, automation interfaces, model libraries, and connectivity with manufacturing execution systems will become key purchasing criteria, driving the market from general-purpose laboratory instruments toward dedicated semiconductor metrology platforms and near-fab automated solutions.

Future growth will be driven primarily by four areas: wide-bandgap semiconductors, AI-related memory and logic capacity, advanced packaging, and emerging functional thin films. The silicon carbide and gallium nitride industries require continuous verification of polytype, offcut angle, composition, strain, and mosaicity across ingot, substrate, and epitaxy stages. Because crystal-quality variation directly affects epitaxial defects and device performance, crystal-orientation measurement and high-resolution diffraction represent relatively non-discretionary requirements. Expansion of AI servers is supporting investment in high-bandwidth memory and advanced logic, while also increasing demand to characterize metal electrodes, dielectric layers, strain-engineered materials, and multilayer structures. This trend encourages further integration of XRD with XRR, grazing-incidence measurements, two-dimensional detection, and automated fitting. In advanced packaging, growing attention to redistribution layers, bonding materials, solders, substrate metals, and package stress is raising the importance of phase, texture, grain, and residual-stress analysis. At the same time, ferroelectric, piezoelectric, two-dimensional, perovskite, and other emerging films are entering device-development programs and require capabilities for weak signals, micro-area measurements, and multiscale structures. The resulting opportunities will be concentrated in systems that can cover multiple materials, geometries, and parameter outputs while maintaining high automation and method stability, as well as in

professional analytical services that combine rapid turnaround with engineering interpretation.

The global competitive landscape is characterized by a small number of international analytical-instrument groups leading high-end wafer metrology, regional specialists covering general-purpose XRD and focused functions, and Chinese suppliers accelerating substitution in conventional instruments and selected multipurpose platforms. Barriers to competition in advanced semiconductor applications extend beyond X-ray sources, goniometer accuracy, and detector performance to include automated wafer handling, optical switching, algorithmic models, method databases, application-engineering experience, and long-term service capability. Customers generally require stable repeatability across materials and lots and expect complex diffraction curves to be converted into composition, strain, thickness, and defect-related indicators, making software and application support increasingly important to both equipment selection and recurring service revenue. Production is concentrated in Japan, the United States, the United Kingdom, Germany, Austria, France, Italy, and China. Japanese, U.S., and European suppliers retain stronger positions in high-resolution wafer systems and mature software ecosystems, while Chinese suppliers are competitive in general-purpose diffractometers, local service, and cost control. Demand is closely aligned with semiconductor manufacturing investment, making mainland China, Taiwan, South Korea, Japan, the United States, and Europe the principal sales regions. Continued expansion of advanced nodes, memory recovery, power-semiconductor adoption, supply-chain localization, and research investment should allow the industry to maintain growth above the average rate of general materials-analysis instruments.

Report Scope

LPI (LP Information)' newest research report, the "Chips XRD Crystal Analysis Industry Forecast" looks at past sales and reviews total world Chips XRD Crystal Analysis sales in 2025, providing a comprehensive analysis by region and market sector of projected Chips XRD Crystal Analysis sales for 2026 through 2032. With Chips XRD Crystal Analysis sales broken down by region, market sector and sub-sector, this report provides a detailed analysis in US\$ millions of the world Chips XRD Crystal Analysis industry.

This Insight Report provides a comprehensive analysis of the global Chips XRD Crystal Analysis landscape and highlights key trends related to product segmentation, company formation, revenue, and market share, latest development, and M&A activity. This report

also analyses the strategies of leading global companies with a focus on Chips XRD Crystal Analysis portfolios and capabilities, market entry strategies, market positions, and geographic footprints, to better understand these firms' unique position in an accelerating global Chips XRD Crystal Analysis market.

This Insight Report evaluates the key market trends, drivers, and affecting factors shaping the global outlook for Chips XRD Crystal Analysis and breaks down the forecast by Measurement Technique, by Application, geography, and market size to highlight emerging pockets of opportunity. With a transparent methodology based on hundreds of bottom-up qualitative and quantitative market inputs, this study forecast offers a highly nuanced view of the current state and future trajectory in the global Chips XRD Crystal Analysis.

This report presents a comprehensive overview, market shares, and growth opportunities of Chips XRD Crystal Analysis market by product type, application, key players and key regions and countries.

Segmentation by Measurement Technique:

Dedicated High-Resolution X-Ray Diffraction

General-Purpose X-Ray Diffraction

Grazing-Incidence or Wide-Angle X-Ray Scattering

Crystal Orientation X-Ray Diffraction

Microbeam or Micro-Area X-Ray Diffraction

Integrated Multimode X-Ray Metrology

Other

Segmentation by Deployment Topology:

Laboratory R&D System

Near-Fab or At-Line System

In-Line Fab System

Outsourced Analysis Service

Other

Segmentation by Target Material:

Silicon and Silicon-Germanium Materials

Silicon Carbide Materials

Group III-Nitride Semiconductors

III-V Arsenide and Phosphide Semiconductors

Other Semiconductor Crystal Materials

Functional Thin Films and Packaging Materials

General Multi-Material Platforms

Other

Segmentation by Application:

Crystal Growth, Substrate Preparation, and Wafer Orientation

Epitaxy Development and Epitaxial Production Control

Silicon Logic and Foundry Process Metrology

Memory and HBM Process Metrology

Power, RF, and Optoelectronic Compound Semiconductor Manufacturing

Advanced Packaging and Interconnect Process Metrology

Academic and Central-Laboratory Materials Research

Other

This report also splits the market by region:

Americas

United States

Canada

Mexico

Brazil

APAC

China

Japan

Korea

Southeast Asia

India

Australia

Europe

Germany

France

UK

Italy

Russia

Middle East & Africa

Egypt

South Africa

Israel

Turkey

GCC Countries

The below companies that are profiled have been selected based on inputs gathered from primary experts and analyzing the company's coverage, product portfolio, its market penetration.

Bruker Corporation

Rigaku Corporation

Spectris plc

Shimadzu Corporation

Anton Paar GmbH

Thermo Fisher Scientific Inc.

STOE & Cie GmbH

Proto Manufacturing Ltd.

Xenocs SAS

GNR S.r.l.

Dandong Haoyuan Instrument Co., Ltd.

Dandong Tongda Science & Technology Co., Ltd.

Dandong Aolong Radiative Instrument Group Co., Ltd.

Contents

1 SCOPE OF THE REPORT

- 1.1 Market Introduction
- 1.2 Years Considered
- 1.3 Research Objectives
- 1.4 Market Research Methodology
- 1.5 Research Process and Data Source
- 1.6 Economic Indicators
- 1.7 Currency Considered
- 1.8 Market Estimation Caveats

2 EXECUTIVE SUMMARY

- 2.1 World Market Overview
 - 2.1.1 Global Chips XRD Crystal Analysis Market Size (2021-2032)
 - 2.1.2 Chips XRD Crystal Analysis Market Size CAGR by Region (2021 VS 2025 VS 2032)
 - 2.1.3 World Current & Future Analysis for Chips XRD Crystal Analysis by Country/Region (2021, 2025 & 2032)
- 2.2 Chips XRD Crystal Analysis Segment by Measurement Technique
 - 2.2.1 Dedicated High-Resolution X-Ray Diffraction
 - 2.2.2 General-Purpose X-Ray Diffraction
 - 2.2.3 Grazing-Incidence or Wide-Angle X-Ray Scattering
 - 2.2.4 Crystal Orientation X-Ray Diffraction
 - 2.2.5 Microbeam or Micro-Area X-Ray Diffraction
 - 2.2.6 Integrated Multimode X-Ray Metrology
 - 2.2.7 Other
 - 2.2.8 Chips XRD Crystal Analysis Market Size by Measurement Technique
 - 2.2.8.1 Chips XRD Crystal Analysis Market Size CAGR by Measurement Technique (2021 VS 2025 VS 2032)
 - 2.2.8.2 Global Chips XRD Crystal Analysis Market Size Market Share by Measurement Technique (2021-2026)
- 2.3 Chips XRD Crystal Analysis Segment by Deployment Topology
 - 2.3.1 Laboratory R&D System
 - 2.3.2 Near-Fab or At-Line System
 - 2.3.3 In-Line Fab System
 - 2.3.4 Outsourced Analysis Service

2.3.5 Other

2.3.6 Chips XRD Crystal Analysis Market Size by Deployment Topology

2.3.6.1 Chips XRD Crystal Analysis Market Size CAGR by Deployment Topology (2021 VS 2025 VS 2032)

2.3.6.2 Global Chips XRD Crystal Analysis Market Size Market Share by Deployment Topology (2021-2026)

2.4 Chips XRD Crystal Analysis Segment by Target Material

2.4.1 Silicon and Silicon-Germanium Materials

2.4.2 Silicon Carbide Materials

2.4.3 Group III-Nitride Semiconductors

2.4.4 III-V Arsenide and Phosphide Semiconductors

2.4.5 Other Semiconductor Crystal Materials

2.4.6 Functional Thin Films and Packaging Materials

2.4.7 General Multi-Material Platforms

2.4.8 Other

2.4.9 Chips XRD Crystal Analysis Market Size by Target Material

2.4.9.1 Chips XRD Crystal Analysis Market Size CAGR by Target Material (2021 VS 2025 VS 2032)

2.4.9.2 Global Chips XRD Crystal Analysis Market Size Market Share by Target Material (2021-2026)

2.5 Chips XRD Crystal Analysis Segment by Application

2.5.1 Crystal Growth, Substrate Preparation, and Wafer Orientation

2.5.2 Epitaxy Development and Epitaxial Production Control

2.5.3 Silicon Logic and Foundry Process Metrology

2.5.4 Memory and HBM Process Metrology

2.5.5 Power, RF, and Optoelectronic Compound Semiconductor Manufacturing

2.5.6 Advanced Packaging and Interconnect Process Metrology

2.5.7 Academic and Central-Laboratory Materials Research

2.5.8 Other

2.5.9 Chips XRD Crystal Analysis Market Size by Application

2.5.9.1 Chips XRD Crystal Analysis Market Size CAGR by Application (2021 VS 2025 VS 2032)

2.5.9.2 Global Chips XRD Crystal Analysis Market Size Market Share by Application (2021-2026)

3 CHIPS XRD CRYSTAL ANALYSIS MARKET SIZE BY PLAYER

3.1 Chips XRD Crystal Analysis Market Size Market Share by Player

3.1.1 Global Chips XRD Crystal Analysis Revenue by Player (2021-2026)

- 3.1.2 Global Chips XRD Crystal Analysis Revenue Market Share by Player (2021-2026)
- 3.2 Global Chips XRD Crystal Analysis Key Players Head office and Products Offered
- 3.3 Market Concentration Rate Analysis
 - 3.3.1 Competition Landscape Analysis
 - 3.3.2 Concentration Ratio (CR3, CR5 and CR10) & (2024-2026)
- 3.4 New Products and Potential Entrants
- 3.5 Mergers & Acquisitions, Expansion

4 CHIPS XRD CRYSTAL ANALYSIS BY REGION

- 4.1 Chips XRD Crystal Analysis Market Size by Region (2021-2026)
- 4.2 Global Chips XRD Crystal Analysis Annual Revenue by Country/Region (2021-2026)
- 4.3 Americas Chips XRD Crystal Analysis Market Size Growth (2021-2026)
- 4.4 APAC Chips XRD Crystal Analysis Market Size Growth (2021-2026)
- 4.5 Europe Chips XRD Crystal Analysis Market Size Growth (2021-2026)
- 4.6 Middle East & Africa Chips XRD Crystal Analysis Market Size Growth (2021-2026)

5 AMERICAS

- 5.1 Americas Chips XRD Crystal Analysis Market Size by Country (2021-2026)
- 5.2 Americas Chips XRD Crystal Analysis Market Size by Measurement Technique (2021-2026)
- 5.3 Americas Chips XRD Crystal Analysis Market Size by Application (2021-2026)
- 5.4 United States
- 5.5 Canada
- 5.6 Mexico
- 5.7 Brazil

6 APAC

- 6.1 APAC Chips XRD Crystal Analysis Market Size by Region (2021-2026)
- 6.2 APAC Chips XRD Crystal Analysis Market Size by Measurement Technique (2021-2026)
- 6.3 APAC Chips XRD Crystal Analysis Market Size by Application (2021-2026)
- 6.4 China
- 6.5 Japan
- 6.6 South Korea

6.7 Southeast Asia

6.8 India

6.9 Australia

7 EUROPE

7.1 Europe Chips XRD Crystal Analysis Market Size by Country (2021-2026)

7.2 Europe Chips XRD Crystal Analysis Market Size by Measurement Technique (2021-2026)

7.3 Europe Chips XRD Crystal Analysis Market Size by Application (2021-2026)

7.4 Germany

7.5 France

7.6 UK

7.7 Italy

7.8 Russia

8 MIDDLE EAST & AFRICA

8.1 Middle East & Africa Chips XRD Crystal Analysis by Region (2021-2026)

8.2 Middle East & Africa Chips XRD Crystal Analysis Market Size by Measurement Technique (2021-2026)

8.3 Middle East & Africa Chips XRD Crystal Analysis Market Size by Application (2021-2026)

8.4 Egypt

8.5 South Africa

8.6 Israel

8.7 Turkey

8.8 GCC Countries

9 MARKET DRIVERS, CHALLENGES AND TRENDS

9.1 Market Drivers & Growth Opportunities

9.2 Market Challenges & Risks

9.3 Industry Trends

10 GLOBAL CHIPS XRD CRYSTAL ANALYSIS MARKET FORECAST

10.1 Global Chips XRD Crystal Analysis Forecast by Region (2027-2032)

10.1.1 Global Chips XRD Crystal Analysis Forecast by Region (2027-2032)

- 10.1.2 Americas Chips XRD Crystal Analysis Forecast
- 10.1.3 APAC Chips XRD Crystal Analysis Forecast
- 10.1.4 Europe Chips XRD Crystal Analysis Forecast
- 10.1.5 Middle East & Africa Chips XRD Crystal Analysis Forecast
- 10.2 Americas Chips XRD Crystal Analysis Forecast by Country (2027-2032)
 - 10.2.1 United States Market Chips XRD Crystal Analysis Forecast
 - 10.2.2 Canada Market Chips XRD Crystal Analysis Forecast
 - 10.2.3 Mexico Market Chips XRD Crystal Analysis Forecast
 - 10.2.4 Brazil Market Chips XRD Crystal Analysis Forecast
- 10.3 APAC Chips XRD Crystal Analysis Forecast by Region (2027-2032)
 - 10.3.1 China Chips XRD Crystal Analysis Market Forecast
 - 10.3.2 Japan Market Chips XRD Crystal Analysis Forecast
 - 10.3.3 Korea Market Chips XRD Crystal Analysis Forecast
 - 10.3.4 Southeast Asia Market Chips XRD Crystal Analysis Forecast
 - 10.3.5 India Market Chips XRD Crystal Analysis Forecast
 - 10.3.6 Australia Market Chips XRD Crystal Analysis Forecast
- 10.4 Europe Chips XRD Crystal Analysis Forecast by Country (2027-2032)
 - 10.4.1 Germany Market Chips XRD Crystal Analysis Forecast
 - 10.4.2 France Market Chips XRD Crystal Analysis Forecast
 - 10.4.3 UK Market Chips XRD Crystal Analysis Forecast
 - 10.4.4 Italy Market Chips XRD Crystal Analysis Forecast
 - 10.4.5 Russia Market Chips XRD Crystal Analysis Forecast
- 10.5 Middle East & Africa Chips XRD Crystal Analysis Forecast by Region (2027-2032)
 - 10.5.1 Egypt Market Chips XRD Crystal Analysis Forecast
 - 10.5.2 South Africa Market Chips XRD Crystal Analysis Forecast
 - 10.5.3 Israel Market Chips XRD Crystal Analysis Forecast
 - 10.5.4 Turkey Market Chips XRD Crystal Analysis Forecast
- 10.6 Global Chips XRD Crystal Analysis Forecast by Measurement Technique (2027-2032)
- 10.7 Global Chips XRD Crystal Analysis Forecast by Application (2027-2032)
 - 10.7.1 GCC Countries Market Chips XRD Crystal Analysis Forecast

11 KEY PLAYERS ANALYSIS

- 11.1 Bruker Corporation
 - 11.1.1 Bruker Corporation Company Information
 - 11.1.2 Bruker Corporation Chips XRD Crystal Analysis Product Offered
 - 11.1.3 Bruker Corporation Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)

- 11.1.4 Bruker Corporation Main Business Overview
- 11.1.5 Bruker Corporation Latest Developments
- 11.2 Rigaku Corporation
 - 11.2.1 Rigaku Corporation Company Information
 - 11.2.2 Rigaku Corporation Chips XRD Crystal Analysis Product Offered
 - 11.2.3 Rigaku Corporation Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
 - 11.2.4 Rigaku Corporation Main Business Overview
 - 11.2.5 Rigaku Corporation Latest Developments
- 11.3 Spectris plc
 - 11.3.1 Spectris plc Company Information
 - 11.3.2 Spectris plc Chips XRD Crystal Analysis Product Offered
 - 11.3.3 Spectris plc Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
 - 11.3.4 Spectris plc Main Business Overview
 - 11.3.5 Spectris plc Latest Developments
- 11.4 Shimadzu Corporation
 - 11.4.1 Shimadzu Corporation Company Information
 - 11.4.2 Shimadzu Corporation Chips XRD Crystal Analysis Product Offered
 - 11.4.3 Shimadzu Corporation Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
 - 11.4.4 Shimadzu Corporation Main Business Overview
 - 11.4.5 Shimadzu Corporation Latest Developments
- 11.5 Anton Paar GmbH
 - 11.5.1 Anton Paar GmbH Company Information
 - 11.5.2 Anton Paar GmbH Chips XRD Crystal Analysis Product Offered
 - 11.5.3 Anton Paar GmbH Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
 - 11.5.4 Anton Paar GmbH Main Business Overview
 - 11.5.5 Anton Paar GmbH Latest Developments
- 11.6 Thermo Fisher Scientific Inc.
 - 11.6.1 Thermo Fisher Scientific Inc. Company Information
 - 11.6.2 Thermo Fisher Scientific Inc. Chips XRD Crystal Analysis Product Offered
 - 11.6.3 Thermo Fisher Scientific Inc. Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
 - 11.6.4 Thermo Fisher Scientific Inc. Main Business Overview
 - 11.6.5 Thermo Fisher Scientific Inc. Latest Developments
- 11.7 STOE & Cie GmbH
 - 11.7.1 STOE & Cie GmbH Company Information

- 11.7.2 STOE & Cie GmbH Chips XRD Crystal Analysis Product Offered
- 11.7.3 STOE & Cie GmbH Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
- 11.7.4 STOE & Cie GmbH Main Business Overview
- 11.7.5 STOE & Cie GmbH Latest Developments
- 11.8 Proto Manufacturing Ltd.
 - 11.8.1 Proto Manufacturing Ltd. Company Information
 - 11.8.2 Proto Manufacturing Ltd. Chips XRD Crystal Analysis Product Offered
 - 11.8.3 Proto Manufacturing Ltd. Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
 - 11.8.4 Proto Manufacturing Ltd. Main Business Overview
 - 11.8.5 Proto Manufacturing Ltd. Latest Developments
- 11.9 Xenocs SAS
 - 11.9.1 Xenocs SAS Company Information
 - 11.9.2 Xenocs SAS Chips XRD Crystal Analysis Product Offered
 - 11.9.3 Xenocs SAS Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
 - 11.9.4 Xenocs SAS Main Business Overview
 - 11.9.5 Xenocs SAS Latest Developments
- 11.10 GNR S.r.l.
 - 11.10.1 GNR S.r.l. Company Information
 - 11.10.2 GNR S.r.l. Chips XRD Crystal Analysis Product Offered
 - 11.10.3 GNR S.r.l. Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
 - 11.10.4 GNR S.r.l. Main Business Overview
 - 11.10.5 GNR S.r.l. Latest Developments
- 11.11 Dandong Haoyuan Instrument Co., Ltd.
 - 11.11.1 Dandong Haoyuan Instrument Co., Ltd. Company Information
 - 11.11.2 Dandong Haoyuan Instrument Co., Ltd. Chips XRD Crystal Analysis Product Offered
 - 11.11.3 Dandong Haoyuan Instrument Co., Ltd. Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)
 - 11.11.4 Dandong Haoyuan Instrument Co., Ltd. Main Business Overview
 - 11.11.5 Dandong Haoyuan Instrument Co., Ltd. Latest Developments
- 11.12 Dandong Tongda Science & Technology Co., Ltd.
 - 11.12.1 Dandong Tongda Science & Technology Co., Ltd. Company Information
 - 11.12.2 Dandong Tongda Science & Technology Co., Ltd. Chips XRD Crystal Analysis Product Offered
 - 11.12.3 Dandong Tongda Science & Technology Co., Ltd. Chips XRD Crystal Analysis

Revenue, Gross Margin and Market Share (2021-2026)

11.12.4 Dandong Tongda Science & Technology Co., Ltd. Main Business Overview

11.12.5 Dandong Tongda Science & Technology Co., Ltd. Latest Developments

11.13 Dandong Aolong Radiative Instrument Group Co., Ltd.

11.13.1 Dandong Aolong Radiative Instrument Group Co., Ltd. Company Information

11.13.2 Dandong Aolong Radiative Instrument Group Co., Ltd. Chips XRD Crystal Analysis Product Offered

11.13.3 Dandong Aolong Radiative Instrument Group Co., Ltd. Chips XRD Crystal Analysis Revenue, Gross Margin and Market Share (2021-2026)

11.13.4 Dandong Aolong Radiative Instrument Group Co., Ltd. Main Business Overview

11.13.5 Dandong Aolong Radiative Instrument Group Co., Ltd. Latest Developments

12 RESEARCH FINDINGS AND CONCLUSION

List Of Tables

LIST OF TABLES

- Table 1. Chips XRD Crystal Analysis Market Size CAGR by Region (2021 VS 2025 VS 2032) & (\$ millions)
- Table 2. Chips XRD Crystal Analysis Annual Sales CAGR by Country/Region (2021, 2025 & 2032) & (\$ millions)
- Table 3. Major Players of Dedicated High-Resolution X-Ray Diffraction
- Table 4. Major Players of General-Purpose X-Ray Diffraction
- Table 5. Major Players of Grazing-Incidence or Wide-Angle X-Ray Scattering
- Table 6. Major Players of Crystal Orientation X-Ray Diffraction
- Table 7. Major Players of Microbeam or Micro-Area X-Ray Diffraction
- Table 8. Major Players of Integrated Multimode X-Ray Metrology
- Table 9. Major Players of Other
- Table 10. Chips XRD Crystal Analysis Market Size CAGR by Measurement Technique (2021 VS 2025 VS 2032) & (\$ millions)
- Table 11. Global Chips XRD Crystal Analysis Market Size by Measurement Technique (2021-2026) & (\$ millions)
- Table 12. Global Chips XRD Crystal Analysis Market Size Market Share by Measurement Technique (2021-2026)
- Table 13. Major Players of Laboratory R&D System
- Table 14. Major Players of Near-Fab or At-Line System
- Table 15. Major Players of In-Line Fab System
- Table 16. Major Players of Outsourced Analysis Service
- Table 17. Major Players of Other
- Table 18. Chips XRD Crystal Analysis Market Size CAGR by Deployment Topology (2021 VS 2025 VS 2032) & (\$ millions)
- Table 19. Global Chips XRD Crystal Analysis Market Size by Deployment Topology (2021-2026) & (\$ millions)
- Table 20. Global Chips XRD Crystal Analysis Market Size Market Share by Deployment Topology (2021-2026)
- Table 21. Major Players of Silicon and Silicon-Germanium Materials
- Table 22. Major Players of Silicon Carbide Materials
- Table 23. Major Players of Group III-Nitride Semiconductors
- Table 24. Major Players of III-V Arsenide and Phosphide Semiconductors
- Table 25. Major Players of Other Semiconductor Crystal Materials
- Table 26. Major Players of Functional Thin Films and Packaging Materials
- Table 27. Major Players of General Multi-Material Platforms

Table 28. Major Players of Other

Table 29. Chips XRD Crystal Analysis Market Size CAGR by Target Material (2021 VS 2025 VS 2032) & (\$ millions)

Table 30. Global Chips XRD Crystal Analysis Market Size by Target Material (2021-2026) & (\$ millions)

Table 31. Global Chips XRD Crystal Analysis Market Size Market Share by Target Material (2021-2026)

Table 32. Chips XRD Crystal Analysis Market Size CAGR by Application (2021 VS 2025 VS 2032) & (\$ millions)

Table 33. Global Chips XRD Crystal Analysis Market Size by Application (2021-2026) & (\$ millions)

Table 34. Global Chips XRD Crystal Analysis Market Size Market Share by Application (2021-2026)

Table 35. Global Chips XRD Crystal Analysis Revenue by Player (2021-2026) & (\$ millions)

Table 36. Global Chips XRD Crystal Analysis Revenue Market Share by Player (2021-2026)

Table 37. Chips XRD Crystal Analysis Key Players Head office and Products Offered

Table 38. Chips XRD Crystal Analysis Concentration Ratio (CR3, CR5 and CR10) & (2024-2026)

Table 39. New Products and Potential Entrants

Table 40. Mergers & Acquisitions, Expansion

Table 41. Global Chips XRD Crystal Analysis Market Size by Region (2021-2026) & (\$ millions)

Table 42. Global Chips XRD Crystal Analysis Market Size Market Share by Region (2021-2026)

Table 43. Global Chips XRD Crystal Analysis Revenue by Country/Region (2021-2026) & (\$ millions)

Table 44. Global Chips XRD Crystal Analysis Revenue Market Share by Country/Region (2021-2026)

Table 45. Americas Chips XRD Crystal Analysis Market Size by Country (2021-2026) & (\$ millions)

Table 46. Americas Chips XRD Crystal Analysis Market Size Market Share by Country (2021-2026)

Table 47. Americas Chips XRD Crystal Analysis Market Size by Measurement Technique (2021-2026) & (\$ millions)

Table 48. Americas Chips XRD Crystal Analysis Market Size Market Share by Measurement Technique (2021-2026)

Table 49. Americas Chips XRD Crystal Analysis Market Size by Application

(2021-2026) & (\$ millions)

Table 50. Americas Chips XRD Crystal Analysis Market Size Market Share by Application (2021-2026)

Table 51. APAC Chips XRD Crystal Analysis Market Size by Region (2021-2026) & (\$ millions)

Table 52. APAC Chips XRD Crystal Analysis Market Size Market Share by Region (2021-2026)

Table 53. APAC Chips XRD Crystal Analysis Market Size by Measurement Technique (2021-2026) & (\$ millions)

Table 54. APAC Chips XRD Crystal Analysis Market Size by Application (2021-2026) & (\$ millions)

Table 55. Europe Chips XRD Crystal Analysis Market Size by Country (2021-2026) & (\$ millions)

Table 56. Europe Chips XRD Crystal Analysis Market Size Market Share by Country (2021-2026)

Table 57. Europe Chips XRD Crystal Analysis Market Size by Measurement Technique (2021-2026) & (\$ millions)

Table 58. Europe Chips XRD Crystal Analysis Market Size by Application (2021-2026) & (\$ millions)

Table 59. Middle East & Africa Chips XRD Crystal Analysis Market Size by Region (2021-2026) & (\$ millions)

Table 60. Middle East & Africa Chips XRD Crystal Analysis Market Size by Measurement Technique (2021-2026) & (\$ millions)

Table 61. Middle East & Africa Chips XRD Crystal Analysis Market Size by Application (2021-2026) & (\$ millions)

Table 62. Key Market Drivers & Growth Opportunities of Chips XRD Crystal Analysis

Table 63. Key Market Challenges & Risks of Chips XRD Crystal Analysis

Table 64. Key Industry Trends of Chips XRD Crystal Analysis

Table 65. Global Chips XRD Crystal Analysis Market Size Forecast by Region (2027-2032) & (\$ millions)

Table 66. Global Chips XRD Crystal Analysis Market Size Market Share Forecast by Region (2027-2032)

Table 67. Global Chips XRD Crystal Analysis Market Size Forecast by Measurement Technique (2027-2032) & (\$ millions)

Table 68. Global Chips XRD Crystal Analysis Market Size Forecast by Application (2027-2032) & (\$ millions)

Table 69. Bruker Corporation Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 70. Bruker Corporation Chips XRD Crystal Analysis Product Offered

Table 71. Bruker Corporation Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 72. Bruker Corporation Main Business

Table 73. Bruker Corporation Latest Developments

Table 74. Rigaku Corporation Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 75. Rigaku Corporation Chips XRD Crystal Analysis Product Offered

Table 76. Rigaku Corporation Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 77. Rigaku Corporation Main Business

Table 78. Rigaku Corporation Latest Developments

Table 79. Spectris plc Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 80. Spectris plc Chips XRD Crystal Analysis Product Offered

Table 81. Spectris plc Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 82. Spectris plc Main Business

Table 83. Spectris plc Latest Developments

Table 84. Shimadzu Corporation Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 85. Shimadzu Corporation Chips XRD Crystal Analysis Product Offered

Table 86. Shimadzu Corporation Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 87. Shimadzu Corporation Main Business

Table 88. Shimadzu Corporation Latest Developments

Table 89. Anton Paar GmbH Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 90. Anton Paar GmbH Chips XRD Crystal Analysis Product Offered

Table 91. Anton Paar GmbH Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 92. Anton Paar GmbH Main Business

Table 93. Anton Paar GmbH Latest Developments

Table 94. Thermo Fisher Scientific Inc. Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 95. Thermo Fisher Scientific Inc. Chips XRD Crystal Analysis Product Offered

Table 96. Thermo Fisher Scientific Inc. Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 97. Thermo Fisher Scientific Inc. Main Business

Table 98. Thermo Fisher Scientific Inc. Latest Developments

Table 99. STOE & Cie GmbH Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 100. STOE & Cie GmbH Chips XRD Crystal Analysis Product Offered

Table 101. STOE & Cie GmbH Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 102. STOE & Cie GmbH Main Business

Table 103. STOE & Cie GmbH Latest Developments

Table 104. Proto Manufacturing Ltd. Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 105. Proto Manufacturing Ltd. Chips XRD Crystal Analysis Product Offered

Table 106. Proto Manufacturing Ltd. Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 107. Proto Manufacturing Ltd. Main Business

Table 108. Proto Manufacturing Ltd. Latest Developments

Table 109. Xenocs SAS Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 110. Xenocs SAS Chips XRD Crystal Analysis Product Offered

Table 111. Xenocs SAS Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 112. Xenocs SAS Main Business

Table 113. Xenocs SAS Latest Developments

Table 114. GNR S.r.l. Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 115. GNR S.r.l. Chips XRD Crystal Analysis Product Offered

Table 116. GNR S.r.l. Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 117. GNR S.r.l. Main Business

Table 118. GNR S.r.l. Latest Developments

Table 119. Dandong Haoyuan Instrument Co., Ltd. Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 120. Dandong Haoyuan Instrument Co., Ltd. Chips XRD Crystal Analysis Product Offered

Table 121. Dandong Haoyuan Instrument Co., Ltd. Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 122. Dandong Haoyuan Instrument Co., Ltd. Main Business

Table 123. Dandong Haoyuan Instrument Co., Ltd. Latest Developments

Table 124. Dandong Tongda Science & Technology Co., Ltd. Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 125. Dandong Tongda Science & Technology Co., Ltd. Chips XRD Crystal

Analysis Product Offered

Table 126. Dandong Tongda Science & Technology Co., Ltd. Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 127. Dandong Tongda Science & Technology Co., Ltd. Main Business

Table 128. Dandong Tongda Science & Technology Co., Ltd. Latest Developments

Table 129. Dandong Aolong Radiative Instrument Group Co., Ltd. Details, Company Type, Chips XRD Crystal Analysis Area Served and Its Competitors

Table 130. Dandong Aolong Radiative Instrument Group Co., Ltd. Chips XRD Crystal Analysis Product Offered

Table 131. Dandong Aolong Radiative Instrument Group Co., Ltd. Chips XRD Crystal Analysis Revenue (\$ million), Gross Margin and Market Share (2021-2026)

Table 132. Dandong Aolong Radiative Instrument Group Co., Ltd. Main Business

Table 133. Dandong Aolong Radiative Instrument Group Co., Ltd. Latest Developments

List Of Figures

LIST OF FIGURES

- Figure 1. Chips XRD Crystal Analysis Report Years Considered
- Figure 2. Research Objectives
- Figure 3. Research Methodology
- Figure 4. Research Process and Data Source
- Figure 5. Global Chips XRD Crystal Analysis Market Size Growth Rate (2021-2032) (\$ millions)
- Figure 6. Chips XRD Crystal Analysis Sales by Geographic Region (2021, 2025 & 2032) & (\$ millions)
- Figure 7. Chips XRD Crystal Analysis Sales Market Share by Country/Region (2025)
- Figure 8. Chips XRD Crystal Analysis Sales Market Share by Country/Region (2021, 2025 & 2032)
- Figure 9. Global Chips XRD Crystal Analysis Market Size Market Share by Measurement Technique in 2025
- Figure 10. Global Chips XRD Crystal Analysis Market Size Market Share by Deployment Topology in 2025
- Figure 11. Global Chips XRD Crystal Analysis Market Size Market Share by Target Material in 2025
- Figure 12. Chips XRD Crystal Analysis in Crystal Growth, Substrate Preparation, and Wafer Orientation
- Figure 13. Global Chips XRD Crystal Analysis Market: Crystal Growth, Substrate Preparation, and Wafer Orientation (2021-2026) & (\$ millions)
- Figure 14. Chips XRD Crystal Analysis in Epitaxy Development and Epitaxial Production Control
- Figure 15. Global Chips XRD Crystal Analysis Market: Epitaxy Development and Epitaxial Production Control (2021-2026) & (\$ millions)
- Figure 16. Chips XRD Crystal Analysis in Silicon Logic and Foundry Process Metrology
- Figure 17. Global Chips XRD Crystal Analysis Market: Silicon Logic and Foundry Process Metrology (2021-2026) & (\$ millions)
- Figure 18. Chips XRD Crystal Analysis in Memory and HBM Process Metrology
- Figure 19. Global Chips XRD Crystal Analysis Market: Memory and HBM Process Metrology (2021-2026) & (\$ millions)
- Figure 20. Chips XRD Crystal Analysis in Power, RF, and Optoelectronic Compound Semiconductor Manufacturing
- Figure 21. Global Chips XRD Crystal Analysis Market: Power, RF, and Optoelectronic Compound Semiconductor Manufacturing (2021-2026) & (\$ millions)

Figure 22. Chips XRD Crystal Analysis in Advanced Packaging and Interconnect Process Metrology

Figure 23. Global Chips XRD Crystal Analysis Market: Advanced Packaging and Interconnect Process Metrology (2021-2026) & (\$ millions)

Figure 24. Chips XRD Crystal Analysis in Academic and Central-Laboratory Materials Research

Figure 25. Global Chips XRD Crystal Analysis Market: Academic and Central-Laboratory Materials Research (2021-2026) & (\$ millions)

Figure 26. Chips XRD Crystal Analysis in Other

Figure 27. Global Chips XRD Crystal Analysis Market: Other (2021-2026) & (\$ millions)

Figure 28. Global Chips XRD Crystal Analysis Market Size Market Share by Application in 2025

Figure 29. Global Chips XRD Crystal Analysis Revenue Market Share by Player in 2025

Figure 30. Global Chips XRD Crystal Analysis Market Size Market Share by Region (2021-2026)

Figure 31. Americas Chips XRD Crystal Analysis Market Size 2021-2026 (\$ millions)

Figure 32. APAC Chips XRD Crystal Analysis Market Size 2021-2026 (\$ millions)

Figure 33. Europe Chips XRD Crystal Analysis Market Size 2021-2026 (\$ millions)

Figure 34. Middle East & Africa Chips XRD Crystal Analysis Market Size 2021-2026 (\$ millions)

Figure 35. Americas Chips XRD Crystal Analysis Value Market Share by Country in 2025

Figure 36. United States Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 37. Canada Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 38. Mexico Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 39. Brazil Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 40. APAC Chips XRD Crystal Analysis Market Size Market Share by Region in 2025

Figure 41. APAC Chips XRD Crystal Analysis Market Size Market Share by Measurement Technique (2021-2026)

Figure 42. APAC Chips XRD Crystal Analysis Market Size Market Share by Application (2021-2026)

Figure 43. China Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 44. Japan Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$

millions)

Figure 45. South Korea Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 46. Southeast Asia Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 47. India Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 48. Australia Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 49. Europe Chips XRD Crystal Analysis Market Size Market Share by Country in 2025

Figure 50. Europe Chips XRD Crystal Analysis Market Size Market Share by Measurement Technique (2021-2026)

Figure 51. Europe Chips XRD Crystal Analysis Market Size Market Share by Application (2021-2026)

Figure 52. Germany Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 53. France Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 54. UK Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 55. Italy Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 56. Russia Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 57. Middle East & Africa Chips XRD Crystal Analysis Market Size Market Share by Region (2021-2026)

Figure 58. Middle East & Africa Chips XRD Crystal Analysis Market Size Market Share by Measurement Technique (2021-2026)

Figure 59. Middle East & Africa Chips XRD Crystal Analysis Market Size Market Share by Application (2021-2026)

Figure 60. Egypt Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 61. South Africa Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 62. Israel Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 63. Turkey Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 64. GCC Countries Chips XRD Crystal Analysis Market Size Growth 2021-2026 (\$ millions)

Figure 65. Americas Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 66. APAC Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 67. Europe Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 68. Middle East & Africa Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 69. United States Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 70. Canada Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 71. Mexico Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 72. Brazil Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 73. China Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 74. Japan Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 75. Korea Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 76. Southeast Asia Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 77. India Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 78. Australia Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 79. Germany Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 80. France Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 81. UK Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 82. Italy Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 83. Russia Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 84. Egypt Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 85. South Africa Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 86. Israel Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 87. Turkey Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

Figure 88. Global Chips XRD Crystal Analysis Market Size Market Share Forecast by Measurement Technique (2027-2032)

Figure 89. Global Chips XRD Crystal Analysis Market Size Market Share Forecast by Application (2027-2032)

Figure 90. GCC Countries Chips XRD Crystal Analysis Market Size 2027-2032 (\$ millions)

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