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Advanced Diamond Materials and Technology Market 2026-2036

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Abstracts

Synthetic diamond is undergoing a structural transformation. While the lab-grown gem and jewellery segment has experienced a 50–80% price collapse since 2020—crystallised by De Beers' closure of its Lightbox brand in May 2025—the technology-grade diamond market is attracting unprecedented investment. Over $4 billion in committed capital flowed into technology-grade diamond manufacturing between 2024 and 2026 alone, driven by demand from AI chip cooling, quantum computing, power electronics, environmental remediation, and defence applications. Diamond's unmatched combination of thermal conductivity (900–2,200 W/m·K), ultra-wide bandgap (5.47 eV), chemical inertness, radiation hardness, and room-temperature quantum coherence positions it as a critical enabling material across multiple high-growth technology sectors.

This comprehensive market report analyses the advanced diamond materials and technology market across five principal segments for the period 2026–2036: lab-grown diamonds (single-crystal CVD and HPHT for gem and technology applications), nanodiamonds (detonation, HPHT, CVD, and fluorescent), diamond semiconductors and power electronics, diamond quantum technologies, and diamond thermal management. A sixth segment—diamond environmental remediation using boron-doped diamond (BDD) electrodes—is analysed separately, reflecting its emergence as a major growth market driven by global PFAS regulations.

The AI thermal management opportunity is a primary market catalyst. GPU power densities now exceed 1,000 watts per chip, creating an urgent thermal bottleneck that conventional cooling materials cannot address. Diamond heat spreaders, copper-diamond composites, GaN-on-Diamond power amplifiers, and diamond thermal interface materials are transitioning from laboratory curiosities to commercial products,

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with Akash Systems already delivering diamond-cooled NVIDIA H200 GPU servers and satellite radios with space heritage.

In diamond semiconductors, the report tracks the emergence of national clusters in Japan, France, and the United States, supported by government programmes including the U.S. CHIPS Act, Japan's NEDO/METI diamond semiconductor initiative, French BPI France investments, and EU REACH/Chips Act designations. Diamond power MOSFETs, Schottky diodes, and GaN-on-Diamond devices are progressing towards commercialisation, with PDS demonstrating packaged diamond MOSFETs at SEMICON Japan 2025 and initiating space qualification testing with JAXA.

The diamond quantum technology market is analysed across three domains: NV-centre quantum sensing (magnetometry, quantum diamond microscopy for semiconductor inspection, navigation), diamond-defect quantum computing (room-temperature NV-centre processors), and diamond quantum networking (photonic interconnects and quantum repeaters). This segment has attracted major corporate investment including the Element Six–Bosch quantum sensing joint venture, IonQ's acquisition of Lightsynq Technologies, and QuantumDiamonds' €152 million Munich production facility designated as a first-of-a-kind facility under the European Chips Act.

The nanodiamond market is assessed across established applications (lubricants, polishing, electroplating, composites) and emerging high-growth segments (quantum biosensing, drug delivery, 3D printing additives, thermal pastes). Fluorescent nanodiamonds containing engineered NV centres represent a convergence point between nanomaterials science and quantum technology.

The diamond environmental remediation segment, driven by EPA PFAS maximum contaminant levels of 4 ppt and the EU REACH near-total PFAS restriction proposal, analyses BDD electrode technology for electrochemical destruction of per- and polyfluoroalkyl substances in municipal water, industrial wastewater, and contaminated groundwater.

Report Contents include:

Executive summary with market taxonomy, key trends, drivers, restraints, and global market size and forecast summary 2026–2036

Properties of diamond materials: mechanical, thermal, electrical, optical, chemical, biocompatibility, nanodiamond properties, NV-centre quantum

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properties, and comparison with competing materials (SiC, GaN, graphene, BN, CNTs)

Synthetic diamond production methods: CVD, HPHT, detonation synthesis, laser ablation, HFCVD, fluorescent nanodiamond production, colour centre engineering, production methods comparison, and pricing analysis

Lab-grown diamonds market: jewellery segment analysis, De Beers Lightbox closure, price dynamics, advanced technology applications, global market forecast by segment and region to 2036

Diamond semiconductor and power electronics market: power transistors, Schottky diodes, MOSFETs, GaN-on-Diamond, satellite communications, AI data centre cooling, space and extreme environments, wafer scaling roadmap, government investments, market forecast by region to 2036

Diamond thermal management market: CVD heat spreaders, copper-diamond composites, diamond-on-silicon, AI/HPC thermal management, advanced semiconductor packaging (TIM1, TIM1.5, 3D packaging), 5G/6G telecommunications, EV power electronics, defence, next-generation thermal solutions, market forecast by region to 2036

Diamond quantum technology market: NV-centre quantum sensing, quantum diamond microscopy, magnetometry, quantum computing, quantum networking and repeaters, Element Six–Bosch JV, government investment, market forecast to 2036

Nanodiamonds market: lubricants, polishing, electroplating, polymer and metal composites, skincare, supercapacitors, batteries, drug delivery, 3D printing, thermal pastes, consumption forecasts by application (tons) and revenue to 2036

Diamond environmental remediation and electrochemistry market: BDD electrode technology, PFAS destruction, municipal and industrial wastewater, groundwater remediation, regulatory drivers, market forecast to 2036

Supply chain, geopolitics, and strategic considerations: global production landscape, supply chain sovereignty, CHIPS Act, export controls, price dynamics, investment landscape

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Market forecasts: total addressable market, segment growth rate ranking, regional analysis, scenario analysis, key uncertainties

Emerging applications: diamond nuclear batteries, in-space manufacturing, Raman lasers, spectroscopy, medical devices, 3D printing, PCD tools

Industry challenges and barriers: wafer scaling, doping asymmetry, manufacturing cost, competing materials, qualification timelines

45 company profiles with technology descriptions, products, funding, headquarters, and strategic positioning

Research methodology and references

Companies Profiled include Akash Systems, Daicel Corporation, Diamfab, Diamond Foundry, Element Six, HiQuTe Diamond, IonQ, NDB Inc. (Nano Diamond Battery), Orbray Co., Photonic Inc., Power Diamond Systems (PDS), Qnami AG, Quantum Brilliance, QuantumDiamonds GmbH and more...

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breakthrough, timeline

Table 104. Industry challenges and barriers — summary assessment

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