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The Global Market for Active, Passive and Solid-State Cooling 2026-2036

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Abstracts

The global cooling market is undergoing a fundamental transformation driven by escalating thermal management demands across virtually every sector of the modern economy. From AI data centers pushing power densities beyond 100 kW per rack to electric vehicles requiring sophisticated battery thermal management, and from 6G communications infrastructure operating at terahertz frequencies to quantum computers demanding millikelvin cryogenic environments, the need for advanced cooling solutions has never been more urgent.

This comprehensive market research report provides an in-depth analysis of the global market for active, passive, and solid-state cooling technologies and materials for the period 2026–2036, with extended forecasts to 2046. The report examines the full spectrum of cooling approaches, from established passive cooling materials such as thermal interface materials (TIMs), phase change materials (PCMs), heat pipes, vapor chambers, and radiative cooling coatings, through to next-generation solid-state technologies including thermoelectric (Peltier) cooling, magnetocaloric, electrocaloric, elastocaloric, LED-based thermophotonic, phononic, and advanced thermionic cooling systems.

The market is being reshaped by powerful converging forces: electrification and energy efficiency mandates are tightening performance standards; and emerging technology sectors—AI computing, electric vehicles, 6G communications, and quantum computing—are creating entirely new thermal management challenges that conventional vapor compression systems cannot address.

Emerging materials are central to the market's evolution. Carbon nanomaterials including graphene, carbon nanotubes, and nanodiamonds are enabling step-change

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improvements in thermal conductivity. Metal-organic frameworks (MOFs) are opening new pathways for solid-state air conditioning. Metamaterials and metasurfaces are enabling passive daytime radiative cooling and precision thermal management at the chip level. Hydrogels and aerogels are finding applications from building cooling to electronics thermal buffering.

The report delivers granular market forecasts segmented by technology type, material category, end-use application, and geography. It covers passive cooling materials, solid-state cooling modules and systems, cryogenic cooling for quantum computing, semiconductor packaging thermal management, data center cooling, EV thermal management, and 6G communications thermal materials. With over 315 company profiles, detailed technology roadmaps, and application suitability mapping from 2025 through 2046, this report is an essential strategic resource for materials suppliers, device manufacturers, system integrators, and investors navigating the rapidly evolving advanced cooling landscape.

The Global Market for Active, Passive and Solid-State Cooling 2026–2036 report delivers comprehensive market intelligence on the advanced cooling technologies and thermal management materials market, projected to experience significant growth driven by AI data centers, electric vehicles, 6G telecommunications, and quantum computing infrastructure demands.

Report coverage includes:

- Passive cooling materials market analysis — thermal interface materials (TIMs), phase change materials (PCMs), graphene and carbon nanotube thermal solutions, heat pipes and vapor chambers, radiative cooling paints and coatings, aerogels, hydrogels, and metal-organic frameworks (MOFs)

- Solid-state cooling technology assessment — thermoelectric (Peltier) cooling, magnetocaloric, electrocaloric, elastocaloric, barocaloric, LED-based thermophotonic cooling, phononic cooling, quantum dot cooling, photonic crystal cooling, and advanced thermionic cooling

- Metamaterials and metasurfaces for thermal management — passive daytime radiative cooling (PDRC), thermal cloaking, metamaterial heat spreaders, and cooling films with global market forecasts to 2036

- Quantum computing cryogenic cooling solutions — dilution refrigeration, adiabatic demagnetization refrigeration (ADR), He-3 free solutions, and cryogenic component market sizing

Semiconductor packaging thermal management — TIM1 and TIM1.5 materials, advanced 2.5D and 3D IC thermal solutions, liquid cooling for HPC, diamond substrates, and AI-enhanced thermal design

6G communications thermal materials — vapor chambers, PDRC for infrastructure, thermoelectric cooling/harvesting, metamaterial thermal management, hydrogel cooling, and ionogels

Data center cooling market — liquid cooling, immersion cooling, chip-level cooling, thermoelectric integration, and heat recovery systems

Electric vehicle thermal management — battery cooling, power electronics, cabin comfort, and ADAS sensor thermal management

Active cooling innovations — electrochromic smart windows, MEMS micro-fan cooling, air conditioner alternatives, and energy storage thermal management

Global market forecasts 2025–2046 segmented by technology, material type, end-use application, and region (North America, Europe, Asia-Pacific, Rest of World)

Technology roadmaps — passive cooling, active cooling, and solid-state cooling development timelines with TRL assessments and commercialization projections

240+ company profiles spanning established thermal management leaders and innovative startups across the global cooling value chain. Companies profiled include: 3M, ABIS Aerogel Co., Accelcius, ADA Technologies, Advanced Thermal Solutions, AegiQ, Aerofybers Technologies, aerogel-it GmbH, Aerogel Technologies, Aerogel UK, AI Technology, Aismalibar, Akash Systems, Anyon Systems, Barocal, Carbice, Corintis, Eaton, Frore Systems, Krosslinker, Magnotherm, Phononic, Sophia Space more...

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