

Advanced Phase Change Materials Market Report by Type (Organic PCM, Inorganic PCM, Bio-Based PCM), Form (Encapsulated, Non-Encapsulated), Application (Building and Construction, Packaging, HVAC, Textiles, Electronics, and Others), and Region 2024-2032

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Abstracts

The global advanced phase change materials market size reached US\$ 1.6 Billion in 2023. Looking forward, IMARC Group expects the market to reach US\$ 4.2 Billion by 2032, exhibiting a growth rate (CAGR) of 11.1% during 2024-2032. A considerable rise in the demand for energy-efficient solutions, increasing emphasis on sustainability and environmental conservation, and continual advancements in thermal management technologies in the automotive industry are some of the major factors propelling the market.

Advanced phase change materials (PCMs) are innovative substances engineered to store and release thermal energy during phase transitions, thereby providing efficient temperature regulation. These materials possess the ability to change their physical state, such as from solid to liquid or vice versa, at specific temperature ranges. By harnessing the principles of latent heat, Advanced PCMs enable effective heat transfer and control, ensuring optimal energy utilization and enhanced system performance. Advanced PCMs have gained significant attention across various industries for their remarkable heat storage and release capabilities, making them ideal for applications where thermal management is crucial.

The global market is primarily driven by the increased adoption of advanced PCMs in medical devices and temperature-controlled packaging in the healthcare sector. In line

with this, the rapid utilization of thermal regulation properties of PCMs to enhance comfort and insulation in sportswear and outdoor fabrics and garments is fueling the market. Moreover, the growing product adoption in thermal energy storage systems to facilitate uninterrupted power generation in the renewable energy sector is providing an impetus to the market. Additionally, extensive research and development (R&D) efforts focused on improving the performance and cost-effectiveness of advanced PCMs are contributing to the market growth. Some of the other factors contributing to the market include rapid urbanization, the introduction of smart grid facilities, increasing vehicle electrification, and continual product innovations.

Advanced Phase Change Materials Market Trends/Drivers:

Rise in the demand for energy-efficient solutions

The demand for energy-efficient solutions in buildings and infrastructure has significantly contributed to the adoption of advanced PCMs. These innovative materials are being incorporated into various construction components, such as concrete and insulation, to improve thermal insulation properties and reduce heating and cooling loads. By integrating Advanced PCMs, buildings can enhance energy conservation, leading to reduced energy consumption and improved sustainability. These materials effectively store and release thermal energy during phase transitions, providing efficient temperature regulation and contributing to the overall energy efficiency of structures. As the focus on energy efficiency continues to grow, the utilization of Advanced PCMs in construction is expected to expand, enabling the development of greener and more sustainable buildings.

An enhanced focus on sustainable development

The market is impelled by an increasing emphasis on sustainability and environmental conservation. Advanced PCMs offer a greener alternative to conventional heating and cooling systems, making them an attractive choice for environmentally conscious businesses and individuals. By leveraging the unique properties of PCMs, such as their ability to store and release thermal energy, these materials minimize energy consumption and contribute to a significant reduction in greenhouse gas emissions. Advanced PCMs play a crucial role in enhancing energy efficiency and sustainability across various industries, including construction, transportation, and renewable energy. As businesses strive to adopt eco-friendly practices and comply with environmental regulations, the demand for Advanced PCMs is expected to rise, further driving the market growth.

Continual advancements in thermal management technologies

The automotive industry is witnessing a rapid adoption of advanced PCMs for thermal management, particularly in electric vehicles (EVs) and hybrid vehicles. These innovative materials are employed in battery packs and thermal management systems to regulate the temperature of the batteries, resulting in enhanced efficiency and extended lifespan. By effectively managing thermal conditions, Advanced PCMs play a critical role in optimizing battery performance and ensuring safe operation. Additionally, the utilization of PCMs in EVs and hybrid vehicles contributes to reduced energy consumption and increased overall vehicle efficiency. As the demand for electric and hybrid vehicles continues to grow, the automotive industry's reliance on Advanced PCMs is expected to expand, driving further advancements in thermal management technologies and propelling the market forward.

Advanced Phase Change Materials Industry Segmentation:

IMARC Group provides an analysis of the key trends in each segment of the global advanced phase change materials market report, along with forecasts at the global and regional levels from 2024-2032. Our report has categorized the market based on type, form and application.

Breakup by Type:

- Organic PCM
- Inorganic PCM
- Bio-Based PCM

Organic PCM dominates the market

The report has provided a detailed breakup and analysis of the market based on the product type. This includes organic PCM, inorganic PCM and bio-based PCM. According to the report, organic PCM represented the largest segment.

The organic PCM segment is being driven by the rising demand for sustainable and environmentally friendly materials, particularly in industries including HVAC, textiles, packaging, and electronics. The growing emphasis on energy efficiency in buildings and construction further fuels the adoption of organic PCM, which is supported by favorable government regulations promoting energy conservation. Additionally, advancements in material science and technology have led to the development of improved organic PCM with enhanced properties, thereby contributing to the segment growth.

On the other hand, inorganic PCM offers high thermal conductivity and stability, making it suitable for a wide range of applications in energy storage, automotive, aerospace, and construction industries. The increasing emphasis on thermal management and waste heat recovery in various sectors is driving the demand for inorganic PCM. Additionally, stringent regulations on greenhouse gas emissions are promoting the adoption of inorganic PCM as an environmentally sustainable solution, leading to increased investments in research and development to further enhance its performance.

Furthermore, the bio-based PCM segment is fueled by increasing awareness and preference for renewable materials, supported by government initiatives to reduce dependence on fossil fuels. The growing demand for bio-based PCM in various applications such as cold chain logistics, textiles, and food processing is driven by its sustainable attributes. Advancements in bio-based PCM technology are leading to enhanced thermal performance and stability, aligning with the heightened focus on reducing carbon footprints and achieving sustainability goals.

Breakup by Form:

Encapsulated

Non-Encapsulated

Encapsulated dominates the market

The report has provided a detailed breakup and analysis of the market based on the form. This includes encapsulated and non-encapsulated. According to the report, encapsulated PCM represented the largest segment.

The compatibility and stability of PCM have significantly improved with the advancement of encapsulation technology, providing enhanced protection against leakage or degradation. This has led to an increasing demand for encapsulated PCM, as it allows for controlled and targeted release in specific applications, and its application areas have expanded to include textiles, electronics, and energy storage. Consequently, there is a rising investment in research and development to develop more efficient and cost-effective encapsulation techniques.

On the other hand, non-encapsulated PCM is favored due to its cost-effectiveness and simplicity, allowing for easy integration into existing systems and products. The construction, building materials, and thermal regulation sectors are experiencing a

growing demand for bulk PCM, as it offers an efficient solution. Moreover, the availability of a wide range of non-encapsulated PCM with varying melting temperatures caters to diverse application requirements. This has further fueled the focus on customized solutions and tailored PCM formulations to meet specific needs.

Breakup by Application:

Building and Construction

Packaging

HVAC

Textiles

Electronics

Others

Building and construction hold the largest share in the market

A detailed breakup and analysis of the market based on the application has also been provided in the report. This includes building and construction, packaging, HVAC, textiles, electronics and others. According to the report, building and construction accounted for the largest market share.

The main factors that are driving the growth of this segment are the rising number of dental offices around the world and the widespread use of aesthetic dentistry by both small- and large-scale dental offices. Additionally, the rise of the market is predicted to increase because of the rising number of dental clinics, majorly in developed countries.

The expansion of the multi-specialty hospitals in both established and developing countries and improved reimbursement rules for operations are also expected to support the expansion of the hospital segment during the forecast period.

Depending on the area, public healthcare tends to provide dentists in industrialized nations with adequate compensation for their services and treatments. Additionally, there might be room for the dental clinics to expand given the growing popularity of the dental franchise model. The advantages of a dental franchise model comprise of enhanced negotiation leverage and cost savings through economies of scale.

Regional Insights:

Europe

North America

Asia Pacific

Middle East and Africa

Latin America

Europe exhibits a clear dominance, accounting for the largest market share

The report has also provided a comprehensive analysis of all the major regional markets, which include Europe, North America, Asia Pacific, Middle East and Africa, and Latin America.

Europe held the biggest market share since the region is focusing on increased implementation of energy-efficient practices in buildings and construction projects. The market in this region is primarily driven by strict regulations and initiatives that promote energy efficiency and sustainability.

Additionally, there is a growing demand for advanced thermal management solutions across various industries in the region. The presence of supportive government policies and incentives further encourages the adoption of PCM technology.

Moreover, there is a strong emphasis on reducing carbon emissions and achieving climate targets, driving the need for innovative solutions such as PCM in the region. Furthermore, the growing interest in renewable energy sources, such as solar and wind power, leading to the accelerating need for PCM in energy storage applications.

Competitive Landscape:

The top players in the market are focusing on research and development activities to innovate and improve the performance of PCM materials and expanding their range of applications. These players are also actively collaborating with industry partners, including manufacturers, researchers, and end-users, to develop customized solutions and address specific market demands. Additionally, they are investing in marketing and promotional activities to raise awareness about the benefits of advanced PCM materials for targeting key sectors and geographies. Furthermore, the major companies are expanding their global presence through strategic mergers and acquisitions, and investments in production facilities. Besides this, they are also emphasizing sustainability by developing environmentally friendly PCM solutions and promoting their use in sustainable systems and building practices.

The report has provided a comprehensive analysis of the competitive landscape in the

market. Detailed profiles of all major companies have also been provided. Some of the key players in the market include:

BASF SE
Cryopak
Entropy Solutions
Honeywell International Inc.
Outlast Technologies LLC
Climator Sweden AB
Croda International Plc
Phase Change Material Products Limited
Phase Change Energy Solutions
Pluss Advanced Technologies Pvt. Ltd.
RGEES, LLC.
Rubitherm Technologies GmbH
Salca BV
SGL Group

Recent Developments:

In June 2023, BASF SE opened Europe's first co-located battery materials and recycling center in Schwarzheide, Germany. This state-of-the-art facility enables the company to produce high-performance cathode active materials and recycle used batteries, effectively closing the loop in the European battery value chain.

In May 2022, Cryopak announced the opening a new facility in Atlanta to cater to the needs of its Southeast customers. The facility, which started operations in December 2021, includes a 60,000 square foot warehouse, a 6,000 square foot maintenance space, a 12,000 square foot office, and room for future expansion.

In July 2021, Entropy Solutions announced their ReachNet LTE Base Station received the first-ever Type Approval Certificate from the National Telecommunications Commission in the Philippines. This LTE base station is approved at Band 3, operating in the 1710-1785MHz and 1805-1880MHz spectrum.

Key Questions Answered in This Report

1. What was the size of the global advanced phase change materials market in 2023?
2. What is the expected growth rate of the global advanced phase change materials market during 2024-2032?
3. What are the key factors driving the global advanced phase change materials market?

4. What has been the impact of COVID-19 on the global advanced phase change materials market?
5. What is the breakup of the global advanced phase change materials market based on the type?
6. What is the breakup of the global advanced phase change materials market based on the form?
7. What is the breakup of the global advanced phase change materials market based on the application?
8. What are the key regions in the global advanced phase change materials market?
9. Who are the key players/companies in the global advanced phase change materials market?

Contents

1 PREFACE

2 SCOPE AND METHODOLOGY

- 2.1 Objectives of the Study
- 2.2 Stakeholders
- 2.3 Data Sources
 - 2.3.1 Primary Sources
 - 2.3.2 Secondary Sources
- 2.4 Market Estimation
 - 2.4.1 Bottom-Up Approach
 - 2.4.2 Top-Down Approach
- 2.5 Forecasting Methodology

3 EXECUTIVE SUMMARY

4 INTRODUCTION

- 4.1 Overview
- 4.2 Key Industry Trends

5 GLOBAL ADVANCED PHASE CHANGE MATERIALS MARKET

- 5.1 Market Overview
- 5.2 Market Performance
- 5.3 Impact of COVID-19
- 5.4 Market Breakup by Type
- 5.5 Market Breakup by Form
- 5.6 Market Breakup by Application
- 5.7 Market Breakup by Region
- 5.8 Market Forecast
- 5.9 SWOT Analysis
 - 5.9.1 Overview
 - 5.9.2 Strengths
 - 5.9.3 Weaknesses

5.9.4 Opportunities

5.9.5 Threats

5.10 Value Chain Analysis

5.10.1 Overview

5.10.2 Research and Development

5.10.3 Raw Material Procurement

5.10.4 Manufacturing

5.10.5 Distribution

5.10.6 Export

5.10.7 End-Use

5.11 Porters Five Forces Analysis

5.11.1 Overview

5.11.2 Bargaining Power of Buyers

5.11.3 Bargaining Power of Suppliers

5.11.4 Degree of Competition

5.11.5 Threat of New Entrants

5.11.6 Threat of Substitutes

5.12 Price Analysis

5.12.1 Key Price Indicators

5.12.2 Price Structure

5.12.3 Price Trends

6 MARKET BREAKUP BY TYPE

6.1 Organic PCM

6.1.1 Market Trends

6.1.2 Market Forecast

6.2 Inorganic PCM

6.2.1 Market Trends

6.2.2 Market Forecast

6.3 Bio-Based PCM

6.3.1 Market Trends

6.3.2 Market Forecast

7 MARKET BREAKUP BY FORM

7.1 Encapsulated

7.1.1 Market Trends

7.1.2 Market Forecast

- 7.2 Non-Encapsulated
 - 7.2.1 Market Trends
 - 7.2.2 Market Forecast

8 MARKET BREAKUP BY APPLICATION

- 8.1 Building and Construction
 - 8.1.1 Market Trends
 - 8.1.2 Market Forecast
- 8.2 Packaging
 - 8.2.1 Market Trends
 - 8.2.2 Market Forecast
- 8.3 HVAC
 - 8.3.1 Market Trends
 - 8.3.2 Market Forecast
- 8.4 Textiles
 - 8.4.1 Market Trends
 - 8.4.2 Market Forecast
- 8.5 Electronics
 - 8.5.1 Market Trends
 - 8.5.2 Market Forecast
- 8.6 Others
 - 8.6.1 Market Trends
 - 8.6.2 Market Forecast

9 MARKET BREAKUP BY REGION

- 9.1 Europe
 - 9.1.1 Market Trends
 - 9.1.2 Market Forecast
- 9.2 North America
 - 9.2.1 Market Trends
 - 9.2.2 Market Forecast
- 9.3 Asia Pacific
 - 9.3.1 Market Trends
 - 9.3.2 Market Forecast
- 9.4 Middle East and Africa
 - 9.4.1 Market Trends
 - 9.4.2 Market Forecast

9.5 Latin America

9.5.1 Market Trends

9.5.2 Market Forecast

10 ADVANCED PHASE CHANGE MATERIALS MANUFACTURING PROCESS

10.1 Product Overview

10.2 Raw Material Requirements

10.3 Manufacturing Process

10.4 Key Success and Risk Factors

11 COMPETITIVE LANDSCAPE

11.1 Market Structure

11.2 Key Players

11.3 Profiles of Key Players

11.3.1 BASF SE

11.3.2 Cryopak

11.3.3 Entropy Solutions

11.3.4 Honeywell International Inc.

11.3.5 Outlast Technologies LLC

11.3.6 Climator Sweden AB

11.3.7 Croda International Plc

11.3.8 Phase Change Material Products Limited

11.3.9 Phase Change Energy Solutions

11.3.10 Pluss Advanced Technologies Pvt. Ltd.

11.3.11 RGEES, LLC.

11.3.12 Rubitherm Technologies GmbH

11.3.13 Salca BV

11.3.14 SGL Group

List Of Tables

LIST OF TABLES

Table 1: Global: Advanced Phase Change Materials Market: Key Industry Highlights, 2023 and 2032

Table 2: Global: Advanced Phase Change Materials Market Forecast: Breakup by Type (in Million US\$), 2024-2032

Table 3: Global: Advanced Phase Change Materials Market Forecast: Breakup by Form (in Million US\$), 2024-2032

Table 4: Global: Advanced Phase Change Materials Market Forecast: Breakup by Application (in Million US\$), 2024-2032

Table 5: Global: Advanced Phase Change Materials Market Forecast: Breakup by Region (in Million US\$), 2024-2032

Table 6: Advanced Phase Change Materials Manufacturing: Raw Material Requirements

Table 7: Global: Advanced Phase Change Materials Market: Competitive Structure

Table 8: Global: Advanced Phase Change Materials Market: Key Players

List Of Figures

LIST OF FIGURES

Figure 1: Global: Advanced Phase Change Materials Market: Major Drivers and Challenges

Figure 2: Global: Advanced Phase Change Materials Market: Sales Value (in Billion US\$), 2018-2023

Figure 3: Global: Advanced Phase Change Materials Market: Breakup by Type (in %), 2023

Figure 4: Global: Advanced Phase Change Materials Market: Breakup by Form (in %), 2023

Figure 5: Global: Advanced Phase Change Materials Market: Breakup by Application (in %), 2023

Figure 6: Global: Advanced Phase Change Materials Market: Breakup by Region (in %), 2023

Figure 7: Global: Advanced Phase Change Materials Market Forecast: Sales Value (in Billion US\$), 2024-2032

Figure 8: Global: Advanced Phase Change Materials Industry: SWOT Analysis

Figure 9: Global: Advanced Phase Change Materials Industry: Value Chain Analysis

Figure 10: Global: Advanced Phase Change Materials Industry: Porter's Five Forces Analysis

Figure 11: Organic PCM (Paraffin Based) Manufacturing: Total Production Cost Breakup (in %)

Figure 12: Global: Advanced Phase Change Materials Market: Average Prices (in US\$/Ton), 2018-2032

Figure 13: Global: Advanced Phase Change Materials (Organic PCM) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 14: Global: Advanced Phase Change Materials (Organic PCM) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 15: Global: Advanced Phase Change Materials (Inorganic PCM) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 16: Global: Advanced Phase Change Materials (Inorganic PCM) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 17: Global: Advanced Phase Change Materials (Bio-Based PCM) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 18: Global: Advanced Phase Change Materials (Bio-Based PCM) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 19: Global: Advanced Phase Change Materials (Encapsulated) Market: Sales

Value (in Million US\$), 2018 & 2023

Figure 20: Global: Advanced Phase Change Materials (Encapsulated) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 21: Global: Advanced Phase Change Materials (Non-Encapsulated) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 22: Global: Advanced Phase Change Materials (Non-Encapsulated) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 23: Global: Advanced Phase Change Materials (Application in Building and Construction) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 24: Global: Advanced Phase Change Materials (Application in Building and Construction) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 25: Global: Advanced Phase Change Materials (Application in Packaging) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 26: Global: Advanced Phase Change Materials (Application in Packaging) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 27: Global: Advanced Phase Change Materials (Application in HVAC) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 28: Global: Advanced Phase Change Materials (Application in HVAC) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 29: Global: Advanced Phase Change Materials (Application in Textiles) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 30: Global: Advanced Phase Change Materials (Application in Textiles) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 31: Global: Advanced Phase Change Materials (Application in Electronics) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 32: Global: Advanced Phase Change Materials (Application in Electronics) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 33: Global: Advanced Phase Change Materials (Other Applications) Market: Sales Value (in Million US\$), 2018 & 2023

Figure 34: Global: Advanced Phase Change Materials (Other Applications) Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 35: Europe: Advanced Phase Change Materials Market: Sales Value (in Million US\$), 2018 & 2023

Figure 36: Europe: Advanced Phase Change Materials Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 37: North America: Advanced Phase Change Materials Market: Sales Value (in Million US\$), 2018 & 2023

Figure 38: North America: Advanced Phase Change Materials Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 39: Asia Pacific: Advanced Phase Change Materials Market: Sales Value (in Million US\$), 2018 & 2023

Figure 40: Asia Pacific: Advanced Phase Change Materials Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 41: Middle East and Africa: Advanced Phase Change Materials Market: Sales Value (in Million US\$), 2018 & 2023

Figure 42: Middle East and Africa: Advanced Phase Change Materials Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 43: Latin America: Advanced Phase Change Materials Market: Sales Value (in Million US\$), 2018 & 2023

Figure 44: Latin America: Advanced Phase Change Materials Market Forecast: Sales Value (in Million US\$), 2024-2032

Figure 45: Advanced Phase Change Materials Manufacturing: Detailed Process Flow

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