

Global Carbon-based Electrode Materials for Flow Batteries Market Growth 2026-2032

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Abstracts

The global Carbon-based Electrode Materials for Flow Batteries market size is predicted to grow from US\$ 85.11 million in 2025 to US\$ 2348 million in 2032; it is expected to grow at a CAGR of 61.8% from 2026 to 2032.

Electrode material is one of the key materials for flow batteries. Unlike lithium-ion batteries, in flow batteries, the energy storage active material is stored in the form of electrolyte in a storage tank outside the stack, and the electrode itself does not participate in electrochemical reactions, only providing a reaction site for the oxidation-reduction reactions of the positive and negative energy storage active materials. The electrode materials of flow batteries are mainly metal and carbon. At present, carbon based electrodes are the most commonly used electrode materials for flow batteries, mainly including graphite felt, carbon felt, graphite carbon paper, and graphite carbon cloth.

The market drivers of carbon electrode materials for flow batteries mainly include:

1. Policy drive: a strategic tool for energy security and carbon neutrality goals

National strategic positioning

Flow batteries are listed as core technologies for energy security and carbon neutrality goals by many governments. China has clearly positioned flow batteries as a "national priority technology" to crack the impact of renewable energy volatility on the power grid. Local policies such as the "Implementation Plan for Promoting the High-Quality Development of the Vanadium Battery Energy Storage Industry" issued by Sichuan Province promote the cost reduction and efficiency improvement of the all-vanadium

flow battery industry chain through financial subsidies, tax incentives and other means to form an industrial cluster.

International competition needs

Against the background of the reshaping of the global energy landscape, flow batteries have become the key to breaking through the "green technology hegemony" of Europe and the United States. With its vanadium resource advantages (accounting for 47% of global reserves) and patent accumulation (global flow battery patents accounted for 38% in 2023), China is expected to reshape global energy governance rules through technology output.

2. Technology-driven: two-way iteration of performance breakthrough and cost reduction

Material innovation and cost reduction

Graphite felt optimization: Through high-temperature graphitization treatment (above 2000°C), the resistivity of carbon felt is reduced to below 0.01 mΩ·cm, and the conductivity is increased by 50%. At the same time, the problem of increased brittleness is alleviated through composite structures (such as carbon felt and polymer composites).

Surface modification technology: Nitric acid oxidation treatment increases oxygen-containing functional groups, which increases the adsorption capacity of vanadium ions by 40%, and significantly improves the catalytic efficiency.

Process localization substitution

3. Industrial chain drive: upstream and downstream synergy and scale effect release

Full industrial chain integration

Upstream resources: Pangang Vanadium Titanium, Hesteel Co., Ltd. and other companies control 47% of the world's vanadium resources and ensure a stable supply of raw materials.

Midstream manufacturing: State Grid Yingda, Shanghai Electric and other companies have conquered the core component technologies such as stacks and electrolytes, and promoted the localization rate of all-vanadium liquid flow batteries to exceed 90%.

Downstream application: Dalian companies in Liaoning have built the world's largest vanadium liquid flow battery energy storage power station (1 GWh), verifying the feasibility of large-scale commercialization.

The scale effect is evident

As the capacity of a single machine jumps from the megawatt level to the gigawatt level, the expansion of production scale and the optimization of manufacturing processes (such as automated production lines) have reduced the cost of battery systems.

IV. Market demand drive: the explosion of renewable energy and the rigid demand for long-term energy storage

Renewable energy distribution and storage demand

Diversified application scenarios

Grid side: The demand for peak-shaving and frequency regulation and power auxiliary services has surged, and flow batteries have become the core of building a "source-grid-load-storage" collaborative system.

User side: Distributed energy storage and microgrid construction are accelerating, such as the promotion of "photovoltaic + flow battery" microgrids in border and island areas.

Special fields: Military bases, data centers, etc. have an urgent need for high-safety energy storage, and the advantage of flow batteries without explosion risks is prominent.

V. Resource and environmental protection drive: circular economy and green premium

Resource recycling

Vanadium electrolyte can be 100% recycled, and the life of carbon electrode materials (such as graphite felt) exceeds 10 years, forming a "resource-product-renewable resource" closed loop. Vanadium-rich areas such as Xinjiang and Sichuan realize resource value-added through electrolyte recycling.

Environmental policy drive

Under the EU Carbon Border Tax (CBAM) and China's "dual carbon" goals, the carbon emissions of liquid flow batteries throughout their life cycle are 30% lower than those of lithium batteries, and they receive an additional premium in green bidding. For example, in the bidding for European microgrid projects, the winning bid price of liquid flow batteries was 15% higher than that of lithium batteries due to their environmental advantages.

The rapid growth of the market for carbon electrode materials for liquid flow batteries is the result of the resonance of five factors: policy support, technological breakthroughs, industrial chain collaboration, demand explosion, and resource environmental protection. With further cost reduction (target 0.1 yuan/kWh) and expansion of application scenarios, carbon electrode materials are expected to become the "infrastructure" of the next generation of energy storage technology and reshape the global energy landscape.

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

This Insight Report provides a comprehensive analysis of the global Carbon-based Electrode Materials for Flow Batteries landscape and highlights key trends related to product segmentation, company formation, revenue, and market share, latest development, and M&A activity. This report also analyzes the strategies of leading global companies with a focus on Carbon-based Electrode Materials for Flow Batteries portfolios and capabilities, market entry strategies, market positions, and geographic footprints, to better understand these firms' unique position in an accelerating global Carbon-based Electrode Materials for Flow Batteries market.

This Insight Report evaluates the key market trends, drivers, and affecting factors shaping the global outlook for Carbon-based Electrode Materials for Flow Batteries and breaks down the forecast by Type, 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 Carbon-based Electrode Materials for Flow Batteries.

This report presents a comprehensive overview, market shares, and growth opportunities of Carbon-based Electrode Materials for Flow Batteries market by product type, application, key manufacturers and key regions and countries.

Segmentation by Type:

Carbon Felt (CF)

Graphite Felt (GF)

Other

Segmentation by Application:

Vanadium Redox Flow Battery

Mixed Flow Battery

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 analysing the company's coverage, product portfolio, its market penetration.

Mige New Material

Shenyang FLYING Carbon Fiber

Liaoning Jingu Carbon Material

CGT Carbon GmbH

SGL Carbon

CeTech

Sichuan Junrui Carbon Fiber Materials

CM Carbon

JNTG

ZH Energy Storage

Tanji Group

Key Questions Addressed in this Report

What is the 10-year outlook for the global Carbon-based Electrode Materials for Flow Batteries market?

What factors are driving Carbon-based Electrode Materials for Flow Batteries market growth, globally and by region?

Which technologies are poised for the fastest growth by market and region?

How do Carbon-based Electrode Materials for Flow Batteries market opportunities vary by end market size?

How does Carbon-based Electrode Materials for Flow Batteries break out by Type, by Application?

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