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Additive Manufacturing – Machines, Materials, Technologies, Applications, New Developments, Industry Structure and Global Markets

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Abstracts

Additive manufacturing (AM), formerly known as rapid prototyping (RP), is defined by the American Society for Testing and Materials (ASTM) as “a process of joining materials to make objects from three-dimensional (3D) model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies.”

AM is also known as 3D printing, and it is among the most important advancements in manufacturing since the Industrial Revolution. Once used strictly for prototyping, it now offers transformative advantages at every phase of product creation, from initial concept design to production of final products and every step in between. The rapidly growing selection of materials, new approaches to automation, and increases in speed are allowing for growth in applications for 3D printing across industries, ranging from aerospace and automotive to durable goods, healthcare, dental care and jewelry.

STUDY GOALS AND OBJECTIVES

This study focuses on providing data about the size and growth of markets, company profiles, and industry trends in AM machines, materials and processes. The goal of this report is to provide a detailed and comprehensive multi-client study of the markets in North America, Europe, Japan, China and the rest of the world (ROW) for these machines, materials and processes, as well as potential business opportunities.

A primary objective of this report is thorough coverage of underlying economic issues driving the development of AM machines, materials and processes, as well as assessments of advanced types of AM machines, materials and processes that are being developed. Another important objective is to provide realistic market data and

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forecasts of growth for AM machines, materials and processes. This study provides the most thorough and up-to-date assessment that can be found anywhere on the subject. The study also provides extensive quantification of the many important facets of worldwide market development for AM machines, materials and processes. This, in turn, contributes to a determination of the kinds of strategic responses companies may adopt in order to compete in these dynamic markets.

Users of AM machines, materials and processes in developed markets must contend with twin pressures – to innovate and, at the same time, to reduce costs. New applications for AM machines, materials and processes have been proposed in recent years. This equipment study condenses all these business-related issues and opportunities.

This iRAP report has been prepared to highlight the many new developments in the additive manufacturing industry. Some of the technology segments are mature, while others are still emerging. Application segments have also been widening. These developments have created a need for a formal analysis of the technological and business issues, trends in technology, application and competition between countries and regions in this market.

REASONS FOR DOING THE STUDY

The diversified businesses of AM machines, materials and processes are complex and fast moving, with manufacturers increasingly adopting a truly global view of the market. Around the world, consumers are demanding high quality as well as an extremely long cycle life. In this challenging market, manufacturers have attempted to achieve growth through company mergers and acquisitions and by implementing global strategies.

Recognizing the new emerging technologies and applications, iRAP has conducted a detailed study and updated technology developments and markets. This report identifies and evaluates new markets and new product developments that show potential growth for AM machines, materials and processes.

The report provides practical and cautionary advice and guidelines for managers, researchers, educators and investors in organizations around the world.

CONTRIBUTIONS OF THE STUDY

This study provides the most complete accounting of the current market and future

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growth in AM machines, materials and processes in North America, Europe, Japan, China and the rest of the world. It provides the most thorough and up-to-date assessment that can be found anywhere on the subject. The study also provides extensive quantification of the many important facets of market developments in emerging markets. This quantification, in turn, contributes to the determination of what kind of strategic responses suppliers might adopt in order to compete in these dynamic markets. Audiences for this study include directors of technology, marketing executives, business unit managers and other decision makers in AM machines, materials and processes companies, as well as the companies peripheral to this business.

FORMAT AND SCOPE

The market data contained in this report quantify opportunities for AM machines, materials and processes equipment. In addition to product types, this report also covers the merits and future prospects of these businesses, including corporate strategies, information technologies, and the means for providing these highly advanced product and service offerings. This report also covers in detail the economic and technological issues regarded by many as critical to the industry's current state of change. It provides a review of the AM machines, materials and processes industry and its structure, and of the many companies involved in providing these products. The competitive positions of the main players in the market, and the strategic options they face, also are discussed, along with such factors as marketing, distribution and operations.

TO WHOM THE STUDY CATERS

The study will benefit existing manufacturers and users of AM machines, materials and processes that seek to grow revenues and develop market opportunities by expanding and diversifying in applications of AM machines, materials and processes equipment based on metal powder, polymers and ceramics, etc., which is positioned to become a preferred solution for many applications. This study also will benefit users of AM machines, materials and processes who are looking for new challenges and applications.

REPORT SUMMARY

Additive manufacturing (AM) has emerged over the past 20 years as a technology that is revolutionizing the manufacturing industry with its ability to turn digital data into physical parts. The distinct ability to manufacture complex shapes and structures has already made it invaluable for the production of prototypes such as engine manifolds for

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the automotive industry and tools such as investment casting molds in the jewelry and aeronautical industries.

In its early years, AM was mostly applied in fabricating conceptual and functional prototypes. These prototypes were most commonly used as communication and inspection tools. Producing several physical models in a short time directly from computer solid models helped to shorten the production development timeline.

Rapid Prototyping (RP) remains the dominant application of polymer AM processes and is well established in the market. Many of the aforementioned technologies are limited to RP, as they do not allow for processing of common engineering materials (polymers, metals, ceramics and composites thereof) with sufficient mechanical properties.

Besides RP, AM for rapid tooling also makes up some of the current AM activity involving the fabrication of molds and dies. For manufacturing applications of AM processes, notable areas of success include the production of medical devices such as dental crowns and hearing aids. Rapid tooling also has been applied to the production of consumer products, including high-value lighting goods and electronics. The aerospace sector also has found a number of applications, often driven by the possibilities of improving buy-to-fly ratios and reducing the weight of components through design optimization. Other areas benefitting from rapid tooling include automotive, jewelry, architecture and defense applications.

AM offers the potential for developing complex, customized products that are prohibitively expensive to produce in current manufacturing settings. AM is poised to bring about a revolution in the way products are designed, manufactured, and distributed to end users. The technology has gained significant academic as well as industry interest due to its ability to create complex geometries with customizable material properties. AM has also inspired the development of the “maker” movement by democratizing design and manufacturing.

Major findings of this report are:

> According to the new study, the 2018 market for AM machines, materials and processes is projected to reach $6,500 million in 2018. It is expected to grow at a compound annual growth rate (CAGR) of 24.5% from 2018 through 2023, to reach $19,500 million in 2023.
>
> Products revenue top 48%, followed by Service Revenue with 38% and other

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miscellaneous with 14%

The 2018 global market for AM machines, materials and processes by application is comprised of motor vehicles, aerospace, industry/business machines, medical devices and products /dental, government/military, architecture, consumer products/electronics, academics institutions and others.

The 2018 global market for additive manufacturing machines, materials and processes by technology, segmented into seven different categories, includes material extrusion, power bed fusion, vet photo-polymerization, material jetting, binder jetting, directed energy deposition, and sheet lamination or laminated object manufacturing (LOM).

In 2018, the AM machines, materials and processes market in North America has the highest market share, followed by Europe, Japan, and China. By 2023, North America is projected to retain the highest market share. By 2023, China is projected to show the highest CAGR%.

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CONSUMABLE ASSEMBLY WITH PAYOUT TUBE FOR ADDITIVE MANUFACTURING SYSTEM
LAYER TRANSFUSION WITH TRANSFIXING FOR ADDITIVE MANUFACTURING
LAYER TRANSFUSION FOR ADDITIVE MANUFACTURING
ELECTROPHOTOGRAPHY-BASED ADDITIVE MANUFACTURING WITH PRE-SINTERING
ENCODED CONSUMABLE MATERIALS AND SENSOR ASSEMBLIES FOR USE IN ADDITIVE MANUFACTURING SYSTEMS
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ADDITIVE MANUFACTURING METHOD FOR BUILDING THREE-DIMENSIONAL OBJECTS WITH CORE-SHELL ARRANGEMENTS
ADDITIVE MANUFACTURING WITH VIRTUAL PLANARIZATION CONTROL
ADDITIVE MANUFACTURING WITH POLYAMIDE CONSUMABLE MATERIALS
SUPPORT STRUCTURES AND DEPOSITION TECHNIQUES FOR 3D PRINTING
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THREE-DIMENSIONAL PRINTING MATERIAL SYSTEM AND METHOD
POWDER COMPOSITIONS AND METHODS OF MANUFACTURING ARTICLES THEREFROM
DIRECT WRITING FOR ADDITIVE MANUFACTURING SYSTEMS
COMPOSITIONS AND METHODS FOR SELECTIVE DEPOSITION MODELLING
PRINTING SYSTEM FOR FORMING THREE DIMENSIONAL OBJECTS
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