NanoMarkets Report

Worldwide Medical Ceramics Markets—2013

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SUMMARY

NanoMarkets believes that medical ceramics represents a major opportunity in the medical materials market over the next few years. They have already established themselves in orthopedic and dental implants; providing a multitude of patients with problem-free bone and tooth replacements. Increasingly, prostheses for hip replacement consist of metal ceramic composites. NanoMarkets also believes that bioceramics and their metal composites have a great potential to heal long segmental bone defects and that in the future, orthopedic implants will rely on scaffold-guided bone tissue.

The primary goal of this report is to identify the market opportunities in the medical ceramics sector over the next eight years. This report not only includes a granular forecast and analysis of the more established medical ceramics markets, but also gives a comprehensive analysis of medical nano-ceramics especially in terms of enhancing the healing properties of implantable materials.

This report discusses the commercial aspects of all the current trends in medical ceramics and the numerous applications in which they can be used. The report also profiles key suppliers and analyzes the complete supply chain for medical ceramics. For the firms covered we discuss their strategies and needs along with their strengths and weaknesses.

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Chapter One: Introduction

1.1 Background to this Report

1.1.1 Two Principal Sectors of the Medical Ceramics Market

In the past, medical ceramics were represented by ceramic and clay implants that remained inert in the host and acted as scaffolds or supports. Today the scenario has changed remarkably due to the introduction of an entirely new generation of bioceramics. These implants are, amazingly, structurally and functionally compatible with living tissue in the human body and contribute to the development of new tissue. Over the past two decades, there has been tremendous improvement in the performance of these bioceramics, and technology advances have created a huge market for ceramics in the medical sector.

The two key markets for medical ceramics are:

- Implantable bioceramics, which consist of medical devices and implants that are on the market as tooth and bone replacements. Bone and joint replacements are essentially metal and ceramic composites, whereas dental implants are mostly made of all-ceramic systems. Bioceramics are a huge success as implantable materials because they are bioactive in their natural compositions and can be fabricated into various composites with metals, both natural and synthetic polymers, carbon fibers, and most recently, carbon nanotubes.

- Medical equipment, including analytical and scientific instrumentation; ceramics are primarily used in analytical, diagnostic, vision, and therapy systems.

Although there are a few risks and ambiguities regarding the use of implants and medical devices based on ceramics, NanoMarkets certainly believes that the market for implantable bioceramics will continue to grow in the future. This growth can possibly be converted into profitable businesses by the companies manufacturing the medical ceramic devices and the firms that supply the necessary raw materials.

1.1.2 Implantable Bioceramics Market Dominated by Tooth and Bone Replacements

Biocompatibility and resistance to wear have made ceramic materials ideal for a range of medical applications, from artificial joints to electronic sensors, stimulators, and drug delivery devices. Alumina and zirconia, among other ceramics, have been successful in withstanding the hostile environment of the human body. The implantable bioceramics market primarily consists of two segments: tooth and bone replacements.

Dental implants: The dental consumables segment includes crowns/bridges, implants, orthodontics, impressive materials, composites, endodontics, adhesives, and cements, while the dental equipment segment is composed of large equipment, such as autoclaves, sterilizers, chairs, communication systems, compressors, cuspidors, and digital imaging systems. Small equipment, including amalgam removal systems, amalgamators, hand piece cleaners, lab equipment, duplicators, and ultrasonic cleaners, also fall into this product segment.

The leading multinational manufacturers account for approximately two thirds of the global implant market and pursue premium strategies. The remainder of the market is very fragmented, consisting of several hundred competitors, the majority of which have a local country or regional focus.

The competition in the global dental implant market is intense, with only a few large players, including Nobel Biocare, Straumann, Dentsply, and Zimmer. The main drivers of the global dental market include low dental implant penetration rates and an increasing worldwide elderly population. Another factor that drives the dental market is longer life expectancies, because an increase in life expectancy results in a more elderly population. Increasing consumer incomes and increasing urban populations are other major factors that are boosting the dental market.

Bone implants: Alumina and zirconia are the main ceramic materials for bone implants, largely due to their mechanical strength and chemical inertness. Morgan Technical Ceramics (MTC) is one of the globally renowned medical ceramic manufacturers that has substantial experience in developing clinically proven ceramic joints using alumina and zirconia.

MTC's Vitox AMC alumina matrix composite bioceramic material used in hip joints has been shown to have exceptionally low wear rates compared with alternative materials. It is therefore a dependable solution that does not have the potential health risks associated with metal hip joints, and it is longer lasting, thus enabling patients to continue to lead active lifestyles.

Medical-grade silicon nitride ceramics have good potential to find applicability in the spinal and arthroplasty segments.

Ceramics are also used in bone tissue engineering because of their osteoinductive and biocompatible properties. Scaffolds that typically act as engineered bone grafts can be used in several specialty applications, such as bone regeneration and wound healing.

1.1.3 Wide Use of Ceramics In Biomedical Equipment

Ceramics are widely used in biomedical equipment, such as ultrasound machines, point-of-care systems, medical test equipment, and imaging instruments. MTC has, for example, launched its piezoceramic objective focusing device that provides the millisecond responsiveness essential for DNA research. Piezoceramics have become the premium choice for medical device manufacturers for the execution of accurate positioning and precise movements.

Because the number of people that need implants is always on the rise, demand for implantable bioceramics and composites continues to increase, while the number of ceramic parts used in biomedical equipment depends on the number of pieces of equipment manufactured and their utility. Thus, NanoMarkets believes that the demand for implantable bioceramics materials will be higher than that for ceramic components used in medical equipment.

1.1.4 Market Opportunities for Implantable Bioceramics Materials

Dental consumables represent the largest segment of the dental care industry, followed by dental equipment. In other words, implantable bioceramics consisting of tooth and bone replacements are in great demand and account for most of the market, while the tools and instruments used during implantation account for just a small part of the overall market.

The scenario described above suggests that not only the number of small implants used by the global population is growing and likely to continue to grow, but also the magnitude of sales are steadily increasing. Due to this steady growth in the small implants market, NanoMarkets expects the bioceramics materials market to continue to grow over the next eight years.

In this growing market, bioceramics materials suppliers will have expanded opportunities to generate new business revenues from both natural substrates and composites and novel manufacturing technologies, such as injection molding and electro-spinning. However, the significant contributors to clinical success will be materials that are bioactive, improve lifetimes, and reduce manufacturing costs.

The implant manufacturing giants like Nobel Biocare, Strauman, and Zimmer offer end-to-end solutions to patients that receive bone and joint replacements, from computed tomography (CT) scans to the actual devices. More than 20 percent of all of the prosthetic elements (tooth-based and implant-based) were produced using computer-aided design/computer-aided manufacturing (CAD/CAM) in 2012. Although the majority of prosthetic elements are still made by hand, the share of dentists using CAD/CAM prosthetic elements continues to increase.

1.1.5 Nanoceramic Composites: Promising But Risky

Ceramic materials fabricated in the form of nano-sized particles show promise in bone tissue regeneration applications. In fact, many in vitro studies have proved beyond a doubt that bone-forming cells called osteoblasts have proliferated on substrates with nanoceramic particles and coatings.

However, when the ceramics are formed into composites with carbon nanotubes (CNTs), cytotoxicity has been observed in some experiments. In addition, nanoceramic polymer composites with amine and amide groups may lead to the accumulation of toxic debris that can evoke inflammatory and/or immune responses and ultimately lead to the rejection of the composite when implanted in a human host. Moreover, the rejection of the implant sometimes can lead to sepsis or septic shock.

Therefore, while nanoceramic composites have potential in the future as implants and medical devices, NanoMarkets believes that key questions about their biocompatibility and bioactive properties must first be addressed before that potential can be realized.

Major implant manufacturers must conduct thorough research studies and, more importantly, appropriate clinical trials before implants and prostheses containing nanoceramic composites are released to the market.

In addition, NanoMarkets has observed that the number of companies offering nanoceramics is growing. Therefore, firms that simply offer acceptable clinical solutions, and not clinically significant advantages, will only be able to compete on price. However, if they can offer a price advantage, because most clinicians are price sensitive, the clinicians may gravitate to the newer lower-cost substitute implants.

1.2 Objectives and Scope of This Report

This report is the latest NanoMarkets report on opportunities in the medical ceramics markets.

NanoMarkets has been providing comprehensive industry analysis of the medical ceramics markets for several years, and this report presents information on the existing markets and emerging opportunities in the field. Thus, the goal of this report is to analyze and forecast the prospects for bioceramic materials and implants in the coming eight years.

We have extensively studied the market dynamics in the medical ceramics materials sector and analyzed what we perceive to be the different opportunities that are emerging for materials used in both implantable bioceramics and ceramics. These opportunities are summarized in detailed forecasts both in revenue and volume terms for all of the predominantly used materials in medical ceramics, as well as the latest substrates and composites.

1.3 Information Sources and Methodology for This Report

NanoMarkets has conducted industry research on medical ceramics and bioceramic materials, and this report is written on the basis of ongoing discussions with key players throughout the industry. In addition, a cumulative analysis of the industry, including the strengths and weaknesses of the major players, was considered when writing this report.

Additional information for this report was drawn from the Internet, commercial databases, trade-press articles, press releases, industry reports and market updates, and corporate literature in order to further understand the activity that is taking place in the medical ceramics market space.

In addition, this report is entirely international in scope. We have conducted interviews worldwide in order to collect information for the report and arrived at the worldwide forecasts without focusing on any specific geographic areas.

The medical ceramics market forecasts presented in this report are drawn from our estimates of both material shipments and manufacturing capacities. We also consider the success rates of the implants and estimate the needs of major medical ceramics producers with respect to their materials suppliers. The materials forecasts are broken down by material type and functionality and fabrication process. The forecasting methods followed and assumptions used when preparing the forecasts in this report are explained in more detail in Chapter Four.

1.4 Plan of This Report

Chapter Two discusses the major ceramics technologies and the various current applications for bioceramics. An explanation of the existing market status with a few insights into the changes that should occur in the market in order to make it more dynamic and profitable is also provided. This analysis forms the basis for our forecasts, which are presented later in Chapter Four of the report.

Chapter Three examines the applications for medical ceramics and reviews the major factors influencing the medical ceramics market with a focus on recent developments in intellectual property (IP), acquisitions, and consolidation. In this chapter, we analyze the R&D strategies of some of the major players in this space with respect to ceramics for use in implants, injectable ceramics, and scaffold-guided bone tissue engineering on bioceramic scaffolds.

We also provide a comprehensive account of notable companies and other organizations influencing the use of ceramics in implants, regenerative medicine, and medical equipment and present our detailed eight-year forecasts of implantable bioceramics and ceramics used in medical instrumentation. The forecasts are organized primarily by application and functionality.

In Chapter Four, we provide summary eight-year forecasts of the bioceramics materials sector based on application, functionality, and type of material, with considerable focus on the processing and fabrication technologies. We also present our eight-year forecasts for key geographies, including the U.S., Europe, Japan, China, and the rest of the world.