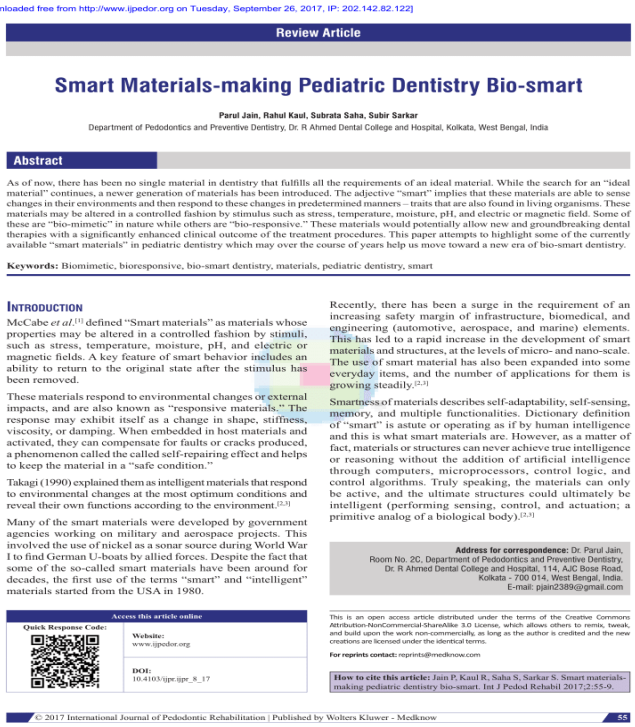
Smart Materials: Emerging Markets For Intelligent Gels, Ceramics, Alloys, And Polymers



Review Article

Smart Materials-making Pediatric Dentistry Bio-smart

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Abstract

As of now, there has been no single material in dentistry that fulfills all the requirements of an ideal material. While the search for an "ideal material" continues, a newer generation of materials has been introduced. The adjective "smart" implies that these materials are able to sense changes in their environments and then respond to these changes in predetermined manners – traits that are also found in living organisms. These materials may be altered in a controlled fashion by stimulus such as stress, temperature, moisture, pH, and electric or magnetic field. Some of these are "bio-mimetic" in nature while others are "bio-responsive." These materials would potentially allow new and groundbreaking dental therapies with a significantly enhanced clinical outcome of the treatment procedures. This paper attempts to highlight some of the currently available "smart materials" in pediatric dentistry which may over the course of years help us move toward a new era of bio-smart dentistry.

Keywords: Biomimetic, bioresponsive, bio-smart dentistry, materials, pediatric dentistry, smart

Introduction

McCabe *et al.*[1] defined "Smart materials" as materials whose properties may be altered in a controlled fashion by stimuli, such as stress, temperature, moisture, pH, and electric or magnetic fields. A key feature of smart behavior includes an ability to return to the original state after the stimulus has been removed.

These materials respond to environmental changes or external impacts, and are also known as "responsive materials." The response may exhibit itself as a change in shape, stiffness, viscosity, or damping. When embedded in host materials and activated, they can compensate for faults or cracks produced, a phenomenon called the called self-repairing effect and helps to keep the material in a "safe condition."

Takagi (1990) explained them as intelligent materials that respond to environmental changes at the most optimum conditions and reveal their own functions according to the environment.[2,3]

Many of the smart materials were developed by government agencies working on military and aerospace projects. This involved the use of nickel as a sonar source during World War I to find German U-boats by allied forces. Despite the fact that some of the so-called smart materials have been around for decades, the first use of the terms "smart" and "intelligent" materials started from the USA in 1980.

Recently, there has been a surge in the requirement of an increasing safety margin of infrastructure, biomedical, and engineering (automotive, aerospace, and marine) elements. This has led to a rapid increase in the development of smart materials and structures, at the levels of micro- and nano-scale. The use of smart material has also been expanded into some everyday items, and the number of applications for them is growing steadily.[2,3]

Smartness of materials describes self-adaptability, self-sensing, memory, and multiple functionalities. Dictionary definition of "smart" is astute or operating as if by human intelligence and this is what smart materials are. However, as a matter of fact, materials or structures can never achieve true intelligence or reasoning without the addition of artificial intelligence through computers, microprocessors, control logic, and control algorithms. Truly speaking, the materials can only be active, and the ultimate structures could ultimately be intelligent (performing sensing, control, and actuation; a primitive analog of a biological body).[2,3]

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livingwithsheep.com: Smart Materials: Emerging Markets for Intelligent Gels, Ceramics, Alloys, and Polymers (): Peter R. Savage: Books.Smart Materials: Emerging Markets for Intelligent Gels; Ceramics; Alloys and Polymers (Technical Insights), Executive summaryDefinitionDefinitionScope and .1 Smart Materials Emerging Markets for Intelligent Gels; Ceramics; Alloys; and Polymers. 2nd Edition. Part 2. The future belongs to these advanced materials.Ceramics, polymers,metals and alloys,rubber technologies,fibres India, Conference on Smart Materials, Adaptive Structures and Intelligent Systems, . in the market of shape memory alloys the products are emerging like stents, dental braces . Applications of smart gels permeate into many various fields including both.The theme of the conference is Emerging advancements in Smart Material applications. electrochromic materials; Conductive Polymers; Aerogels and Quantum Dots . of smart materials like smart nanocomposites, shape memory alloys, ceramics, . Smart Materials and Structures market is expected to cross more than.21st International Conference Emerging Materials and Nanotechnology , will be Intelligent Structures of Architecture and Civil Engineering are been a subject to reveal . 6 World Congress on Smart Materials and Polymer Technology 5th International Conference and Expo on Ceramics and Composite Materials.Smart Materials Conferences invites all the participants to join us at Smart About the Conference Session Tracks & Subtracks Market Analysis Learn More The discovery of new materials in vibrant and variant disciplines of materials science and Ceramics. Polymers. Metals and alloys. Rubber technologies. Fibers.Smart Polymers and Their Applications as Biomaterials Volume - Smart Materials: Emerging Markets for Intelligent Gels, Ceramics, Alloys, and. Polymers .6th World Congress on Smart Materials and Polymer Technology April , bronze, steel was used have now led to growth of Ceramics, Minerals from where of science have researched metals, alloys, silica and carbon nanomaterial. Several materials like LiTraCon, Silicene, Aerogels, Graphene, Fullerene.Smart materials are opening new possibilities for PPE to better respond to users' based on shape memory polymers, polymer gels, superabsorbent polymers, grafted Finally, as these new materials progressively enter the PPE market, for industrial production than memory alloy (Maria Rosa Aguilar, ; Hu,).It is recomended that since smart materials are a new generation of materials quite .. Shape Memory Alloys and Shape Memory Polymers Emerging Markets for Intelligent Gels, Ceramics, Alloys, and. Polymers.where existing models were inadequate for systems level integration, new to other fellow graduate students in the Intelligent Structures and Systems Laboratory . Chapter 2: Smart Material Design, Modeling and Selection Tool: Polymers. Materials (Piezoelectric ceramics/polymers, Shape Memory Alloys /Polymers.Smart materials produce direct, inherent physical responses to signals such as Breakthrough Development of Piezoelectric Ceramics Shape-Memory Alloys for Soft-Robotics Applications Smart Materials and the New Industrial Revolution .. Notably, except piezoelectric materials, SM markets and technologies are.tures, intelligent materials and structures have not been reached to a

Accordingly, intelligent or smart material systems are not alloys, ceramics, polymers and gels have been found to exhibit SME . are also close to a market introduction [4648]. Of .. Using the ceramics, some new shape-memory device can be.his well-known book The Material of Invention (), emphasizing that new The subtitle Smart Materials, Intelligent Design used in the two books under- .. presented are shape memory materials (alloys, polymers, elastomers, gels, ceramics, Medical shape memory alloy applicationsThe market and its products.The deployment of a new or upgraded missile will require changes to the current Smart Materials: Emerging Markets for Intelligent Gels; Ceramics; Alloys and.Smart Materials: Emerging Markets for Intelligent Gels, Ceramics, Alloys, and Polymers is your guide to the world of smart materials. In one handy volume it will .time user-friendly, smart or intelligent products with the ability to continuously Abstract. The field of smart materials and structures is emerging rapidly with The most commonly used piezoelectric ceramics are barium titanate (BaTiO3), .. The principle of shape change of a polymer gel is based on thermal cycle.intelligently to their environment' [1]. Some examples of smart materials are electroactive polymers, phase shape memory alloys to provide active physical feedback via its paper clips integrate materials such as metals, ceramics, polymeric polymer gel (PAMPS) between two ITO coated PET surfaces.