Advanced Ceramics For Dentistry Chapter 2 Teeth

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Microstructure, Properties and Degradation

DASHAWN COCHRAN

From Research to Clinical Practice
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The chapter is focused on the processing of bulk advanced ceramics. A general overview of ceramic processes is presented with the focus on processes relevant to advanced ceramics in dentistry. The processing of ceramics is divided into four parts that describe the basic steps: powder treatment, shaping of ceramic green bodies, drying and binder removal, and sintering. The first part discusses the reasons for powder treatment. The causes of powder agglomeration are explained and possible dispersion techniques are given. The principles of the most important methods of dry, wet, and plastic shaping, and consolidation of green bodies are explained. The mechanisms of solvent drying and binder removal from consolidated green bodies are discussed and the potential problems of this processing step are highlighted. The densification of green bodies via sintering is explained and possible sintering techniques are described. Advantages and disadvantages of particular sintering methods are discussed.

Handbook of Advanced Ceramics
Elsevier Inc. Chapters
As the demand for healthy, attractive teeth increases, the methods and materials employed in restorative dentistry have become progressively more advanced. Non-metallic biomaterials for tooth repair and replacement focuses on the use of biomaterials for a range of applications in tooth repair and, in particular, dental restoration. Part one reviews the structure, modification and repair of dental tissues. The properties of enamel and dentin and their role in adhesive dental restoration are discussed, along with biomineralization and biomimicry of tooth enamel, and enamel matrix proteins (EMPs) for periodontal regeneration. Part two goes on to discuss the processing, bonding and wear properties of dental ceramics, glasses and sol-gel derived bioactive glass ceramics for tooth repair and replacement. Dental composites for tooth repair and replacement are then the focus of part three, including composite adhesive and antibacterial restorative materials for dental applications. The effects of particulate filler systems on the properties and performance of dental polymer composites are considered, along with composite based oral implants, fibre reinforced composites (FRCs) as dental materials and luting cements for dental applications. With its distinguished editor and international team of expert contributors, Non-metallic biomaterials for tooth repair and replacement provides a clear overview for all those involved in the development and application of these materials, including academic researchers, materials scientists and dental clinicians. Discusses the properties of enamel and dentin and their role in adhesive dental restoration Chapters also examine the wear properties of dental ceramics, glasses and bioactive glass ceramics for tooth repair and replacement Dental composites and antibacterial restorative mateirals are also considered

Chapter 5.1. Glass-Ceramics BoD – Books on Demand
Fractographic analysis is a useful tool for finding fracture origins that is necessary for improving the reliability of ceramic restorations. The general analysis begins with the determination of fracture patterns and origins. The crack propagation markings found by examination of fracture surfaces allow one to follow crack paths and to trace back to an origin, including fracture mirror, hackle, Wallner line, arrest line, and compression curl. This method is introduced and applied to define the origins of common clinical failures of ceramic dental prostheses. They are classified as several major types, namely, cracking initiated at the margin or at occlusal contacts, and porcelain chipping or delamination. The fracture origin is always found near the spot where the highest tensile stress concentration accumulates, and/or microscopic defects or flaws are located nearby. The fracture of ceramic dental restorations may initiate at micro-defects in the porcelain or ceramic body that are introduced during the materials fabrication process or after clinical adjustment.

Advanced Operative Dentistry E-Book Butterworth-Heinemann
Tooth defects and missing teeth are common oral diseases that threaten the patient's health, aesthetics, and self-confidence. Prosthodontics is a dental specialty with a long history of providing artificial prostheses to restore or replace the damaged or missing teeth and dentition of patients. Based on type and degree, there are three main categories of tooth damage: tooth defect, partial edentulism, and complete edentulism. Various prosthetic treatments are available for restoration, and each of them has its specific advantages and limitations. This means thect, the patient's oral and general health condition, and the individual's expectation. In thiat the decision to pursue prosthetic treatment should be made by fully understanding the characteristics of the defs chapter, background knowledge of the characteristics of tooth defects and edentulism are introduced in combination with commonly used prostheses. Despite the fact that there are no omnipotent prostheses, some general guidelines of prostheses selection are given.

Advanced Ceramics for Dentistry Springer Science & Business Media
The mechanical reliability and aesthetic appearance of ceramic dental prostheses are strongly influenced by the presence of defects. When several processes are used during fabrication of ceramic dental prostheses, additional defects are unavoidably introduced in each process step; these are in addition to the ones that already exist in raw materials. To avoid the degeneration of material performance by the accumulated defect population, process optimization is needed to minimize the defects introduced. Standardized mechanical evaluations are usually performed on samples with carefully prepared surfaces in order to minimize the influence from the defects usually induced by fabrication processes. The results from such mechanical evaluation indicate the strength level that is achievable by the material with the given population of bulk defects. In order to avoid a reduction in the performance of the ceramic material by the additional defects normally induced by the fabrication process, it must be understood how these defects are

introduced, and solutions must be found to reduce their size and frequency through modifications of the material and processes. The aim of this chapter is to elucidate the sources of defects that are common for ceramic dental prostheses and to determine how to minimize them.

Bioceramics Woodhead Publishing
Applications of Advanced Ceramics in Science, Technology, and Medicine explores a broad range of advanced ceramic materials and their innovative applications in distinct fields. Chapters cover applications such as actuators, energy storage, environmental health and monitoring, 3D printing, electronics, biomedical engineering and EMI shielding. Chapters provide readers with an overview of the structural and fundamental properties, synthesis strategies and versatile applications of advanced ceramic materials and their composites. The information in the volume will be beneficial for students, research scholars, faculty members and R&D specialists working in the area of material science, nanotechnology, solid-state science, chemical engineering, power sources and renewable energy storage.

Phillips' Science of Dental Materials - E-Book Elsevier Inc. Chapters
This book gives an introduction to the mechanical behavior and degradation of dental ceramics and guides the reader through their performance under effect of oral environments. It addresses the different kinds of dental ceramics, their properties, degradation and mechanical aspects with less emphasys on the physics and chemistry involved, which makes the reading interesting for beginners in the field. In each chapter, the reader will learn about the mechanical behavior of dental ceramics and each phenomenon involved in their application, besides finding some practical examples of their use in dental clinics, their manufacturing procedures and types of degradation. The clear language and the application-oriented perspective of the book makes it suitable for both professionals and students who want to learn about dental ceramics.

Chapter 5. Clinical Failures of Ceramic Dental Prostheses Royal Society of Chemistry
Ceramic materials are currently applied to two categories of restorative dentistry, as all-ceramic fixed-partial dentures and as implantable components. While the former demands mainly integrated and balanced properties of mechanical and aesthetic origins, the latter also relies strongly on the material’s bio-oriented properties. This chapter discusses the material demands for solving the problems encountered in current practice that indicate the direction for future developments. This is done by bearing in mind both process restrictions and compatibilities. Focus is placed on developing materials that have the potential for improving aesthetics, for preserving a healthy situation to secure a prolonged treatment survival, and for improving the durability and reliability of the restorations while also simplifying the procedures of materials manufacture and clinical operation. Biomimetic materials and processes related to them are topics of general importance from a long perspective.

Electric and Magnetic Ceramics, Bioceramics, Ceramics and Environment
Advanced Ceramics for DentistryChapter 11. Alumina- and Zirconia-based Ceramics for Load-bearing Applications Feldspathic porcelains, leucite, and lithium disilicate glass-ceramics are

important materials used in restorative dentistry for their biocompatibility, excellent aesthetic properties, good mechanical strength, and relative ease of use. As a general rule in clinical practice, the choice of material should be dictated by the specific clinical situation. It depends on the space available to build the aesthetic and functional restoration, but also on the nature of the underlying tooth or restorative structure. The best aesthetic results are obtained with feldspathic porcelain restorations directly resin-bonded to the tooth, whereas the best function is obtained with the stronger and tougher fully anatomical or veneered glass-ceramic crowns and bridges. The main limitation with these ceramics is their insufficient strength for use as posterior crowns and bridges. Possible means to obtain aesthetically pleasing and long-term performing posterior restorations are the development of stronger glass-ceramics, the use of translucent colored zirconia, or the use of the new class of more elastic hybrid polymer-ceramic materials.

Advanced Ceramics for Dentistry John Wiley & Sons

This chapter reviews the structure, mechanical properties, and biocompatibility of load-bearing ceramics used in dentistry. The development of this class of ceramic biomaterials is traced from the late sixties when alumina was introduced in dentistry. The literature on both polycrystalline and single crystal alumina dental implants is reviewed. The use of alumina declined when zirconia-toughened ceramics were introduced in orthopedics in the eighties. The use of yttria partially-stabilized tetragonal zirconia (Y-TZP) in dentistry allowed the production not only of dental implants and abutments, but also a broad range of load-bearing fixed partial dentures, such as multi-unit bridges and crowns, thanks to the development of CAD/CAM technology. Today, the trend is to use alumina and zirconia ceramics for making more aesthetic parts by improving their optical translucency.

Chapter 18. Advanced Direct Forming Processes for the Future John Wiley & Sons

Wiggs’s Veterinary Dentistry: Principles and Practice, Second Edition is a fully updated and expanded new edition of the classic comprehensive reference for veterinary dentistry. Provides current, comprehensive information on veterinary dentistry Encompasses rudimentary tenets of the field as well as advanced techniques Presents the state-of-the-art in veterinary dentistry, with all topics fully updated, revised, and expanded to reflect current knowledge Written by leading veterinary dental specialists and edited by luminaries in the field Includes more images and color throughout to support the text

Dental Ceramics Elsevier Inc. Chapters

1. Scientific Aspects of Dental Ceramic Materials. -- 2. Processing Methods. -- 3. Veneers. -- 4. All-ceramic Single Crowns. -- 5. Non-vital Abutment Teeth. -- 6. External Bleaching. -- 7. All-ceramic Fixed Partial Dentures. -- 8. Bonding of Ceramic Restorations. -- 9. All-ceramic Implant Supported Restoration.

Advances in Ceramic Materials Elsevier Inc. Chapters

Titanium and titanium alloys are considered standard materials for dental implants with very well documented, high rates of success and survival. Potential immunologic and aesthetic drawbacks associated with titanium implants have resulted in the

development of alternatives like zirconia-based dental implants. Zirconia seems to be a suitable implant material because of its tooth-like color, mechanical properties, biocompatibility, and low plaque affinity. However, the use of zirconia in clinical implant dentistry is still controversial. The aim of this chapter is to review clinical and research articles conducted on zirconia dental implants, and to provide information on zirconia dental implant osseointegration, mechanical strength, and microbiology. Compared to titanium-based dental implants zirconia implants show promising results in clinical studies. However, there are a limited number of long-term studies on the outcome of zirconia implants and additional clinical research needs to be done to fully appraise zirconia-based dental implants.

Dental Ceramics Springer

Dental Materials at a Glance, 2nd edition, is the latest title in the highly popular At a Glance series, providing a concise and accessible introduction and revision aid. Following the familiar, easy-to-use at a Glance format, each topic is presented as a double-page spread with key facts accompanied by clear diagrams encapsulating essential information. Systematically organized and succinctly delivered, Dental Materials at a Glance covers: Each major class of dental material and biomaterial Basic chemical and physical properties Clinical handling and application Complications and adverse effects of materials Dental Materials at a Glance is the ideal companion for all students of dentistry, residents, and junior clinicians. In addition, the text will provide valuable insight for general dental practitioners wanting to update their materials knowledge and be of immediate application for dental hygienists, dental nurses, dental assistants, and technicians.

Advanced Ceramics for Dentistry Elsevier Health Sciences

Implants into the human body, such as hip joints, heart valves and dental crowns, have been increasingly used over the last 40 years or so, and many patients have benefited from their use. But how much is known about the metals, ceramics and polymers that are used in these repairs? This book provides a state-of-the-art account of the chemistry of the synthetic materials used in medicine and dentistry. It looks at the properties and interactions of these materials within the body at a molecular level, and includes discussion of bioengineering and cell biology. In addition, there is an account of the surgical procedures used, as well as extensive coverage of the possible biological reactions to the presence of foreign materials in the body. A brief look at the emerging field of tissue engineering completes the text. Fully referenced, with detailed reviews of the current literature, The Chemistry of Medical and Dental Materials will be an essential starting-point for all those in academia and industry who are involved in the development of new and improved repair materials.

Chapter 12. Dental Glasses and Glass-ceramics Elsevier Health Sciences

The current book consists of twenty-four chapters divided into three sections. Section I includes fourteen chapters in electric and magnetic ceramics which deal with modern specific research on dielectrics and their applications, on nanodielectrics, on piezoceramics, on glass ceramics with para-, anti- or ferro-electric active phases, of varistors

ceramics and magnetic ceramics. Section II includes seven chapters in bioceramics which include review information and research results/data on biocompatibility, on medical applications of alumina, zirconia, silicon nitride, ZrO2, bioglass, apatite-wollastonite glass ceramic and b-tri-calcium phosphate. Section III includes three chapters in applications of ceramics in environmental improvement and protection, in water cleaning, in metal bearing wastes stabilization and in utilization of wastes from ceramic industry in concrete and concrete products.

Chapter 14. Surface Modifications of Load-Bearing Ceramics for Improved Osseointegration Elsevier Inc. Chapters

Ceramic materials are frequently and increasingly used in dentistry. However, they are very brittle, the tensile strength has a large scatter, and their total fracture strain is very low. The strength depends on the loaded volume and on time under load. These properties cause special needs with respect to design, manufacturing tolerances, and handling, in production as well as in application. In ceramics, strength is limited by small flaws that are either caused by the processing of the material or by the machining of surfaces of specimens and components. This chapter introduces the principles of linear elastic fracture mechanics as the basis for understanding brittle fracture, and then presents fracture statistics. These topics are followed by an example for designing with ceramics. In subsequent sections, several other damage mechanisms and their relevance in dental applications will be discussed. The chapter closes with sections that deal with mechanical testing of ceramics and fractography.

Advanced Ceramics for Dentistry Elsevier Inc. Chapters

In the early 1980s the industrialization of products based on the osseointegration principle discovered by Professor Per-Ingvar Brånemark started. The industrialization system has since gone through digitalization and automation, where now computer-aided imprisoning, design, and milling are standard features of a highly flexible production process for customized products. Lab production and central production are two ways of producing dental products. The central production principle offers the potential for better economy of scale and turnover of products, and the local dental lab can offer a higher degree of customization and personal service. Quality of dental products has always been of central importance and continues to grow. New technology and a highly digital treatment process are open for even better quality by the use of production simulations and tolerance analysis in all parts of the manufacturing process.

Encyclopedia of Glass Science, Technology, History, and Culture Two Volume Set Elsevier Inc. Chapters

Teeth are vital organs of vertebrates of which the main function is to bite and chew food into pieces. Human teeth are always an essential concern in appearance and beauty, and they play an important role in everything from word pronunciation to the protection of support organs. The right anatomical shape and arrangement of teeth are the basis for these functions. Each tooth contains three hard calcified tissues, including enamel, dentin, and cementum, and one soft tissue, pulp, which contains blood vessels, nerves, and is connected with the periodontal tissue by a narrow root canal. The

development, formation, composition, microstructure, optical and mechanical properties, and common defects of and damages to human teeth are reviewed in this chapter. This knowledge is of importance in restorative dentistry for designing preventive treatments to maintain tissue integrity and to replace damaged tissues with synthetic materials (e.g. ceramics, which mimic the natural appearance and performance of teeth).

Advanced Ceramics for Dentistry

BoD – Books on Demand

This chapter gives an introduction to advanced ceramics from the perspective of restorative dentistry. Fundamentals of composition and functionality are used for defining and classifying advanced ceramics. A historical overview helps differentiate advanced ceramics from traditional ceramics. The focus of the chapter is on linking ceramic properties to their compositions and structures described hierarchically from the atomic level onward.

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