Advanced Ceramics For Dentistry Chapter 2 Teeth

This book covers the area of advanced ceramic composites broadly, providing important introductory chapters to fundamentals, processing, and applications of advanced ceramic composites. Within each section, specific topics covered highlight the state of the art research within one of the above sections. The organization of the book is designed to provide easy understanding by students as well as professionals interested in advanced ceramic composites. The various sections discuss fundamentals of nature and characteristics of ceramics, processing of ceramics, processing and properties of toughened ceramics, high temperature ceramics, nanoceramics and nanoceramic composites, and bioceramics and biocomposites.

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.

This Elsevier title is a Pageburst product which provides you with the printed volume PLUS an e-book. Pageburst (formerly Evolve eBooks) allows you to quickly search the entire book, make notes, add highlights, and study more efficiently. Buying other Pageburst titles makes your learning experience even better: all of the eBooks will work together on your electronic 'bookshelf' so that you can search across your entire electronic library. Advanced Operative Dentistry: A Practical Approach is a brand new volume that addresses the use of fixed prosthodontics in a single handy reference source. Prepared by editors and contributors of international renown, this volume places unique emphasis on the biological basis of effective treatment planning by describing the diagnosis, aetiology, risk assessment and preventive management of diseases and disorders and how these factors are integral to predictable long-term patient outcomes. Advanced Operative Dentistry: A Practical Approach also gives clear advice on the selection and use of modern dental materials and describes how teeth are prepared – and to what extent – for indirect restorations such as crowns, bridges, veneers, inlays and onlays. The book also explores the use of complex indirect fixed prosthodontics which brings with it specific issues of restoration design, retention and occlusal management. Recognising that great deal of emphasis is placed on aesthetic dentistry by patient and dentist alike, this text also discusses factors which can impact upon aesthetics and how the aesthetic demands of patients can be met in a realistic and ethical manner. Clearly written and fully illustrated throughout, this practical step-by-step guide will be ideal for undergraduate dental students, vocational trainees and practitioners undertaking post-graduate exams. Prepared by editors and contributors of international renown Contains an abundance of full colour, clinical illustrations to show the results that can be achieved in real life Describes how to achieve the best appearance in order to meet increasing patient expectations Discusses the use of fixed prosthodontics in one volume and how fixed and removable prosthodontics can be integrated Gives unique emphasis on the preventative, biological approach to the use of fixed prosthodontics in order to ensure positive long-term treatment outcomes Clearly illustrates why aspects of tooth preparation are necessary and how the construction of restorations influences their fit Provides an integrated, multidisciplinary step-by-step guide to the provision of indirect fixed restorations Provides guidance on effective communication with laboratory staff to ensure high-quality tooth preparation Describes the correct handling of materials and restorations when being fitted Presents the latest findings regarding the use of contemporary materials and techniques – such as the use of Expasyl, Protemp temporary crowns, CAD and CAM crowns Comprehensive coverage of the subject area makes cross-referencing to other books unnecessary

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.

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.

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.

The additive manufacturing (AM) family of techniques has been developed during the last few decades. The techniques are used in order to fabricate 3D parts, layer-by-layer, directly from CAD data. Instrument development has come to the point where they are now used as production facilities for individually designed components, mostly in the fields of organic polymers and metallic alloys. Application of these techniques to the manufacture of ceramic parts is much more challenging. Its feasibility for the future production of customized ceramic parts in restorative dentistry will be determined by the progress in control of dimensional tolerance, the residual stress, and their characteristic heterogeneous microstructures. This chapter introduces the basic principles of the AM family of techniques.

Provides comprehensive coverage of the research into and clinical uses of bioceramics and biocomposites Developments related to bioceramics and biocomposites appear to be one the most dynamic areas in the field of biomaterials, with multiple applications in tissue engineering and medical devices. This book covers the basic science and engineering of bioceramics and biocomposites for applications in dentistry and orthopedics, as well as the state-of-the-art aspects of biofabrication techniques, tissue engineering, remodeling, and regeneration of bone tissue. It also provides insight into the use of bionanomaterials to create new functionalities when interfaced with biological molecules or structures. Featuring contributions from leading experts in the field, Bioceramics and Biocomposites: From Research to Use in Clinical Practice offers complete coverage of everything from extending the concept of hemopoietic and stromal niches, to the evolution of bioceramic-based scaffolds. It looks at perspectives on and trends in bioceramics in endodontics, and discusses the influence of newer biomaterials use on the structuring of the clinician’s attitude in dental practice or in orthopedic surgery. The book also covers such topics as biofabrication techniques for bioceramics and biocomposites; glass ceramics: calcium phosphate coatings; brain drug delivery bone substitutes; and much more. Presents the biggest trends in bioceramics and biocomposites relating to medical devices and tissue engineering products Systematically presents new information about bioceramics and biocomposites, developing diagnostics and improving treatments and their influence on the clinicians' approaches Describes how to use these biomaterials to create new functionalities when interfaced with biological molecules or structures Offers a range of applications in clinical practice, including bone tissue engineering, remodeling, and regeneration Delineates essential requirements for resorbable bioceramics Discusses clinical results obtained in dental and orthopedic applications Bioceramics and Biocomposites: From Research to Use in Clinical Practice is an excellent resource for biomaterials scientists and engineers, bioengineers, materials scientists, and engineers. It will also benefit mechanical engineers and biochemists who work with biomaterials scientists.

Bioactive ceramics are used as bulk, porous bodies, or surface-active layers on dental implants and as morphogenetically active scaffolds inserted into the jawbone. While the former has been popularly applied as artificial dental roots for recovering the function of lost teeth, the latter are increasingly used for regenerating bone tissue. In both cases, the common fundamental basis is to understand how the new bone is formed on the surfaces of introduced foreign bodies, integrated together with the autologous bone through complex biological processes and cell-materials interactions. Efforts are thus made in this chapter to elucidate the biological origins of those phenomenological terms that have often eluded satisfactory scientific definition on this particular topic of practice-motivated science. Bone-growth mechanisms are discussed together with possible characterization and quantification methods. The role of surface morphology and multi-scale structures in promoting bone growth is emphasized. Based on the state-of-the-art understanding all the way down to molecular, cellular, and genetic levels, bioactive ceramics are categorized and presented in relation to their potential applications in dentistry. The design concept of implants for enhancing early healing and for enabling immediate loading is also discussed.

-Detailed dental implant laboratory procedures for multiple clinical conditions with recent advances -Extensive chapter on virtual laboratory -Laboratory disinfection protocol for COVID-19 -Detailed discussion of metal ceramics and all ceramics -More than 3400 coloured photos and illustrations -More than 100 flowcharts and diagrams for easy understanding -Mouthguards and TMJ appliances -Digital version and videos for enhanced learning -Comprehensive laboratory reference for prosthodontists and clinicians

High-performance bioceramics, such as zirconia, alumina, and their composites, are attractive materials for the fabrication of load-bearing bone implants because of their outstanding mechanical properties, biocompatibility, corrosion resistance, and aesthetic quality. However, a lot of additional work is still needed on these ceramics before their full potential as implant materials can be exploited, especially in the area of surface optimization. The two most important issues relating to the surface of ceramic implants that need to be addressed are surface chemistry and topography. They both have an influence on protein adsorption and cell behavior and play a key role in providing sufficient biomechanical stability for the long-term success of implants. Therefore, extensive studies have been performed that are aimed at a

better understanding of how specific surface modifications affect the biological response. In this chapter, various surface-modification techniques are described and their potential for improving the osseointegration of ceramic implants is discussed.

Biomaterials created from innovative glass and bioceramic research are emerging as a precursor to several developments useful for solving a wide variety of industry and health related issues. Current Trends on Glass and Ceramic Materials is a review on the latest developments in glass and ceramic materials for technological applications along with biomedical applications in vivo. The volume serves as a useful reference to readers interested in learning about this area of materials science and its multidisciplinary array of applications

The growth of implant and fixed prosthodontics practices in dentistry has created a rapidly increasing demand for advanced ceramics and ceramic processes. Innovations in ceramics and ceramic processes are vital to ensure reliable and affordable dental-restoration solutions with aesthetically pleasing outcomes. The work aims to engage the bioceramics and engineering communities to meet the challenges of modern dental restoration using advanced ceramics. Incorporating fundamental science, advanced engineering concepts, and clinical outcomes, the work is suitable for bioceramicists, ceramics manufacturers, dental clinicians and biologists. State-of-the-art-coverage encompasses bioresorbable ceramics for bone regeneration and bioactivating surfaces of inert, high-strength ceramics for implantation, keeping research knowledge appropriately updated Discusses transition from the baseline stable and physically stiff ceramics research into engineering of highly coherent laminate composites for prosthetic crowns and bridges Showcases current feasible techniques for producing, in cost-effective and materials-saving ways, long-lasting individualized ceramic components with biocompatibility, complexity and high precision

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.

This book examines exciting advancements in the field of ceramics, including nanotechnology, clean energy, and tribology as well as fundamental concepts like defects and structure. It is a comprehensive discussion on how today’s ceramics are processed and used in many of today’s critical technologies. It discusses current techniques for synthesizing durable and cost-effective ceramic components with biocompatibility, complexity, and high precision. This book is a comprehensive reference for researchers, engineers, dental clinicians, biologists, academics, and students interested in ceramics.

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.

The main sections/chapters of the book focus on the composition of nine types of bioceramics, other simple oxides and more and the medical applications of these materials in orthopaedics, dentistry and the treatment of cancerous tumors.

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.

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.

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.

Presenting a comprehensive exploration of restorative dental materials, this book provides the information readers need to know to correctly use dental materials in the clinic and dental laboratory. Ranging from fundamental concepts to advanced skills, it also provides the scientific basis for technical procedures and manipulation of materials.

This new edition presents information and knowledge on the field of biomedical devices and surgical tools. The authors look at the

interactions between nanotechnology, nanomaterials, design, modeling, and tools for surgical and dental applications, as well as how nanostructured surfaces can be created for the purposes of improving cell adhesion between medical devices and the human body. Each original chapter is revised in this second edition and describes developments in coatings for heart valves, stents, hip and knee joints, cardiovascular devices, orthodontic applications, and regenerative materials such as bone substitutes. There are also 8 new chapters that address: Microvascular anastomoses Inhaler devices used for pulmonary delivery of medical aerosols Surface modification of interference screws Biomechanics of the mandible (a detailed case study) Safety and medical devices The synthesis of nanostructured material Delivery of anticancer molecules using carbon nanotubes Nano and micro coatings for medical devices This book is appropriate for engineers, material scientists, chemists, physicists, biologists, medical and dental professionals with an interest in biomedical devices and tools, and researchers in the same fields.

Microstructure characterization of advanced ceramics involves qualitative and quantitative analysis of surface topography, porosity, crystal defects, and interfaces. The structure of the surface controls interaction of ceramics with its surroundings, such as adhesion, gas adsorption, and electron exchange, which play an important role in determining overall properties of a material. Pores in ceramic materials originate from incomplete densification during the sintering process. Their presence interferes with functional properties such as mechanical strength, optical transparency, electrical conductivity, and dielectric response. Crystal defects mostly form either as a result of imperfections during the crystal growth process or as a consequence of structural phase transitions. They generally affect most functional properties of materials. So-called extended defects are interfaces that are boundaries between two solids. The most widespread tools for characterization of ceramic microstructures are microscopic techniques involving optical microscopy, different types of electron microscopy, and various scanning-probe methods. This chapter gives a brief introduction of the features of ceramic microstructure and the corresponding techniques for characterizing them.

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.

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.

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

This book discusses the current biomaterials used for dental applications and the basic sciences underpinning their application. The most critical structures in the oral cavity are the teeth, which play a central role in speaking, biting, chewing, tasting and swallowing. Teeth consist of three types of tissue: the cementum, enamel and dentin, with bone and gingival tissue serving as supporting structures. Caries, tooth wear, trauma and mechanical defects can lead to severe facial conditions; however, correcting these defects remains a challenge for scientists and dentists. Presenting insights form a broad range of disciplines, including materials science, biology, physiology and clinical science, this book provides a timely review of the principles, processing and application of dental materials.

Titanium-based dental implants and abutments exhibit excellent biocompatibility and mechanical properties. Both early wound healing and bone formation and soft tissue healing towards abutments are well understood. This chapter elucidates whether ceramic surfaces provide appropriate conditions for soft and hard tissue healing.

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 Dental Biomaterials is an invaluable reference for researchers and clinicians within the biomedical industry and academia. The book can be used by both an experienced researcher/clinician learning about other biomaterials or applications that may be applicable to their current research or as a guide for a new entrant into the field who needs to gain an understanding of the primary challenges, opportunities, most relevant biomaterials, and key applications in dentistry. Provides a comprehensive review of the materials science, engineering principles and recent advances in dental biomaterials Reviews the fundamentals of dental biomaterials and examines advanced materials’ applications for tissues regeneration and clinical dentistry Written by an international collaborative team of materials scientists, biomedical engineers, oral biologists and dental clinicians in order to provide a balanced perspective on the field

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.

Covering both popular and advanced cosmetic procedures, Contemporary Esthetic Dentistry enhances your skills in the dental treatments leading to esthetically pleasing restorations. With over 1,600 full-color illustrations, this definitive reference discusses the importance of cariology and caries management, then covers essential topics such as ultraconservative dentistry, color and shade, adhesive techniques,

anterior and posterior direct composites, and finishing and polishing. Popular esthetic treatment options are described in detail, including bleaching or tooth whitening, direct and porcelain veneers, and esthetic inlays and onlays. Coverage of advanced cosmetic procedures includes implants, perioesthethics, ortho-esthetics, and pediatric esthetics, providing a solid understanding of treatments that are less common but can impact patient outcomes. Developed by Dr. George A. Freedman, a renowned leader in the field, Contemporary Esthetic Dentistry also allows you to earn Continuing Education credits as you improve your knowledge and skills. Continuing Education credits are available, allowing you to earn one to two CE credits per chapter. Detailed coverage of popular esthetic procedures includes bleaching, direct and porcelain veneers, inlays and onlays, posts and cores, porcelain-fused-to-metal restorations, zirconium crowns and bridges, and complete dentures. Coverage of advanced procedures includes implants, perioesthethics, ortho-esthetics, pediatric esthetics, and sleep-disordered breathing, providing a solid understanding of less-frequently encountered topics that impact the esthetic treatment plan and outcomes. Coverage of key esthetic dentistry topics and fundamental skills includes cariology and caries management, understanding dental materials, photography, understanding and manipulating of color and shade, adhesive techniques, anterior and posterior direct composites, and finishing and polishing. Over 1,600 full-color photos and illustrations help to clarify important concepts and techniques, and show treatments from beginning of the case to the final esthetic results. Well-known and respected lead author George A. Freedman is a recognized author, educator, and speaker, and past president of the American Academy of Cosmetic Dentistry and co-founder of the Canadian Academy for Esthetic Dentistry. Expert contributors are leading educators and practicing clinicians, including names such as Irvin Smigel (the father of esthetic dentistry), Chuck N. Maragos (the father of contemporary diagnostics), Wayne Halstrom (a pioneer in the area of dental sleep medicine), David Clark (one of the pioneers of the microscope in restorative dentistry and founder the Academy of Microscope Enhanced Dentistry), Edward Lynch (elected the most influential person in UK Dentistry in 2010 by his peers), Joseph Massad (creator, producer, director, and moderator of two of the most popular teaching videos on the subject of removable prosthodontics), Simon McDonald (founder and CEO of Triodent Ltd, an international dental manufacturing and innovations company), and many more!

Advanced Ceramics for DentistryChapter 11. Alumina- and Zirconia-based Ceramics for Load-bearing ApplicationsElsevier 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).

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.

This is the Proceedings of III Advanced Ceramics and Applications conference, held in Belgrade, Serbia in 2014. It contains 25 papers on various subjects regarding preparation, characterization and application of advanced ceramic materials.