Monotonic and Fatigue Loading Behavior of an Oxide/Oxide Ceramic Matrix Composite

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Monotonic and Fatigue Loading Behavior of an Oxide/Oxide Ceramic Matrix Composite-Steven G. Steel 2000-03-01 This thesis evaluates an oxide/oxide ceramic matrix composite, N720/ A, for high temperature aerospace applications. The composite consists of a porous alumina matrix reinforced by ten plies of Nextel 720 fibers in a balanced 8 harness satin weave. Monotonic tensile and fatigue tests were performed at room temperature and 1200 C. The effect of moisture on 1200 C fatigue life was also examined. Modulus, maximum and minimum strain, and stress-strain hysteresis were monitored to characterized fatigue damage. Retained strength of all specimens that survived 100000 fatigue cycles was tested. Microscopy and
Fractography were used to examine damage and fracture surfaces. N720/A was found to have good room temperature properties. At room temperature the ultimate tensile strength was 144 MPa and fatigue strength was 102 MPa. Fatigue damage involved mainly matrix cracking with no fiber-matrix debonding. At 1200 C the ultimate strength was 140 MPa and fatigue strength was 122 MPa. Fatigue damage was similar to room temperature with the addition of creep in the fibers. Exposure to moisture did not degrade fatigue performance. N720/A appears to be an excellent candidate for 1200 C applications with exposure to moisture.

Monotonic and Fatigue Behavior of 2-D Woven Ceramic Matrix Composite at Room and Elevated Temperatures (Blackglas/Nextel 312) - Musa Al-Hussein 1998-09-01

This study investigated the monotonic tension and compression and the tension-tension and tension-compression fatigue loading of Blackglas/Nextel 312 woven CMC at room temperature and at 760 degrees centigrade. Young's Modulus and strain variation were evaluated. S-N curves were obtained for room and elevated temperatures. The ultimate tensile stress was lower at the elevated temperature and it was higher in the compression test. Failure-strain was higher at the elevated temperature in both tension and compression tests. There was no significant change in Young's Modulus at the elevated temperature. Also, there was no difference in the number of cycles to failure at the elevated temperature between tension-tension and tension-compression fatigue loading. Microscopic examination was performed to characterize damage mechanisms.

25th Annual Conference on Composites, Advanced Ceramics, Materials, and Structures - B-Mrityunjay Singh 2009-09-28 This volume is part of the Ceramic Engineering and Science
Proceeding (CESP) series. This series contains a collection of papers dealing with issues in both traditional ceramics (i.e., glass, whitewares, refractories, and porcelain enamel) and advanced ceramics. Topics covered in the area of advanced ceramic include bioceramics, nanomaterials, composites, solid oxide fuel cells, mechanical properties and structural design, advanced ceramic coatings, ceramic armor, porous ceramics, and more.

**Structural Health Monitoring 2003**-Fu-Kuo Chang 2003 Important new information on sensors, monitoring, prognosis, networking, and planning for safety and maintenance.

**Non-Destructive Evaluation (NDE) of Polymer Matrix Composites**-Vistasp M. Karbhari 2013-06-30 The increased use of polymer matrix composites in structural applications has led to the growing need for a very high level of quality control and testing of products to ensure and monitor performance over time. Non-destructive evaluation (NDE) of polymer matrix composites explores a range of NDE techniques and the use of these techniques in a variety of application areas. Part one provides an overview of a range of NDE and NDT techniques including eddy current testing, shearography, ultrasonics, acoustic emission, and dielectrics. Part two highlights the use of NDE techniques for adhesively bonded applications. Part three focuses on NDE techniques for aerospace applications including the evaluation of aerospace composites for impact damage and flaw characterisation. Finally, the use of traditional and emerging NDE techniques in civil and marine applications is explored in part four. With its distinguished editor and international team of expert contributors, Non-destructive evaluation (NDE) of polymer matrix composites is a technical resource for researchers and engineers using polymer matrix composites, professionals
requiring an understanding of non-destructive evaluation techniques, and academics interested in this field. Explores a range of NDE and NDT techniques and considers future trends. Examines in detail NDE techniques for adhesively bonded applications. Discusses NDE techniques in aerospace applications including detecting impact damage, ultrasonic techniques and structural health monitoring.

**High Temperature Mechanical Behaviour of Ceramic Composites** - Karl Jakus, 1995-06-28

High Temperature Mechanical Behavior of Ceramic Composites provides an up-to-date comprehensive coverage of the mechanical behavior of ceramic matrix composites at elevated temperatures. Topics include both short-term behavior (strength, fracture toughness and R-curve behavior) and long-term behavior (creep, creep-fatigue, delayed failure and lifetime). Emphasis is on a review of fundamentals and on the mechanics and mechanisms underlying properties. This is the first time that complete information of elevated temperature behavior of ceramic composites has ever been compacted together in a single volume. Of particular importance is that each chapter, written by internationally recognized experts, includes a substantial review component enabling the new material to be put in proper perspective. Shanti Nair is Associate Professor at the Department of Mechanical Engineering at the University of Massachusetts at Amherst. Karl Jakus is Professor at the University of Massachusetts at Amherst.


Quasibrittle (or brittle heterogeneous) materials are becoming increasingly important for modern engineering. They include concretes, rocks, fiber composites, tough ceramics, sea ice, bone, wood, stiff soils, rigid foams, glass, dental and biomaterials, as well as all brittle materials on the micro
or nano scale. Their salient feature is that the fracture process zone size is non-negligible compared to the structural dimensions. This causes intricate energetic and statistical size effects and leads to size-dependent probability distribution of strength, transitional between Gaussian and Weibullian. The ensuing difficult challenges for safe design are vanquished in this book, which features a rigorous theory with detailed derivations yet no superfluous mathematical sophistication; extensive experimental verifications; and realistic approximations for design. A wide range of subjects is covered, including probabilistic fracture kinetics at nanoscale, multiscale transition, statistics of structural strength and lifetime, size effect, reliability indices, safety factors, and ramification to gate dielectrics breakdown.

**Long Term Durability of Structural Materials** - P.J.M. Monteiro 2001-08-29

"Long Term Durability of Structural Materials" features proceedings of the workshop held at Berkeley, CA in October, 2000. It brought together engineers and scientists, who have received grants from the initiative NSF 98-42, to share their results on the study of long-term durability of materials and structures. The major objective was to develop new methods for accelerated short-term laboratory or in-situ tests which allow accurate, reliable, predictions of the long-term performance of materials, machines and structures. To achieve this goal it was important to understand the fundamental nature of the deterioration and damage processes in materials and to develop innovative ways to model the behavior of these processes as they affect the life and long-term performance of components, machines and structures. The researchers discussed their approach to include size effects in scaling up from laboratory specimens to actual structures.

Accelerated testing and durability modeling techniques developed were validated by comparing their results with performance.
under actual operating conditions. The main mechanism of the deterioration discussed included environmental effects and/or exposure to loads, speeds and other operating conditions that are not fully anticipated in the original design. A broad range of deterioration damage, such as fatigue, overload, ultraviolet damage, corrosion, and wear was presented. A broad range of materials of interest was also discussed, including the full spectrum of construction materials, metals, ceramics, polymers, composites, and coatings. Emphasis was placed on scale-dependence and history of fabrication on resulting mechanical behavior of materials.

**Advances in Ceramic Matrix Composites XI**

Narottam P. Bansal
2012-04-11 Contained in this proceeding is a variety of papers that discuss recent advances in ceramic matrix composites. Topics include processing, characterization, geopolymers, environmental effects, coatings, and mechanical properties.

**Maintenance, Safety, Risk, Management and Life-Cycle Performance of Bridges**

Nigel Powers
2018-07-04 Maintenance, Safety, Risk, Management and Life-Cycle Performance of Bridges contains lectures and papers presented at the Ninth International Conference on Bridge Maintenance, Safety and Management (IABMAS 2018), held in Melbourne, Australia, 9-13 July 2018. This volume consists of a book of extended abstracts and a USB card containing the full papers of 393 contributions presented at IABMAS 2018, including the T.Y. Lin Lecture, 10 Keynote Lectures, and 382 technical papers from 40 countries. The contributions presented at IABMAS 2018 deal with the state of the art as well as emerging concepts and innovative applications related to the main aspects of bridge maintenance, safety, risk, management and life-cycle performance. Major topics include: new design methods, bridge codes, heavy vehicle and load models,
bridge management systems, prediction of future traffic models, service life prediction, residual service life, sustainability and life-cycle assessments, maintenance strategies, bridge diagnostics, health monitoring, non-destructive testing, field testing, safety and serviceability, assessment and evaluation, damage identification, deterioration modelling, repair and retrofitting strategies, bridge reliability, fatigue and corrosion, extreme loads, advanced experimental simulations, and advanced computer simulations, among others. This volume provides both an up-to-date overview of the field of bridge engineering and significant contributions to the process of more rational decision-making on bridge maintenance, safety, risk, management and life-cycle performance of bridges for the purpose of enhancing the welfare of society. The Editors hope that these Proceedings will serve as a valuable reference to all concerned with bridge structure and infrastructure systems, including students, researchers and engineers from all areas of bridge engineering.

**Effect of Fiber Fabric Orientation on the Monotonic and Fatigue Behavior of a Continuous Fiber Ceramic Composite**

1994 The monotonic fast fracture and fatigue behavior of a Nextel{trademark} 312 reinforced SiC matrix composite was investigated. Effect of fabric orientation with respect to the loading axis on the monotonic and fatigue behavior of the composite was examined. Two geometries were investigated: transverse, where fiber fabric is perpendicular to loading direction; and edge-on where the fabric is parallel to the loading axis. The edge-on geometry showed higher flexure strengths than the transverse orientation. The different deformation mechanisms between the edge-on and transverse orientations were due to strong in-plane shearing of the fiber fabric and weak interlaminar shear of the plies, respectively. In cyclic fatigue, stress versus cycles
(S-N) curves showed high fatigue endurance limits in both orientations, although the transverse orientation survived more cycles than the edge-on orientation at stresses slightly above the endurance limit.

Pavement Cracking-Imad L. Al-Qadi 2008-07-30
Internationally, much attention is given to causes, prevention, and rehabilitation of cracking in concrete, flexible, and composite pavements. The Sixth RILEM International Conference on Cracking in Pavements (Chicago, June 16-18, 2008) provided a forum for discussion of recent developments and research results. This book is a collection of papers fr

Handbook of Ceramic Composites-Narottam P. Bansal 2006-08-25 This valuable handbook has been compiled by internationally renowned researchers in the field. Each chapter is focused on a specific composite system or a class of composites, presenting a detailed description of processing, properties, and applications.

Proceedings of the International Conference on Smart Materials, Structures and Systems-1999

Analysis of Engineering Structures and Material Behavior-Josip Brnic 2018-01-18 Theoretical and experimental study of the mechanical behavior of structures under load. Analysis of Engineering Structures and Material Behavior is a textbook covering introductory and advanced topics in structural analysis. It begins with an introduction to the topic, before covering fundamental concepts of stress, strain and information about mechanical testing of materials. Material behaviors, yield criteria, and loads imposed on the engineering elements are also discussed. The book then moves on to cover more advanced areas including relationships.
between stress and strain, rheological models, creep of metallic materials and fracture mechanics. Finally, the finite element method and its applications are considered. Key features: Covers introductory and advanced topics in structural analysis, including load, stress, strain, creep, fatigue and finite element analysis of structural elements. Includes examples and considers mathematical formulations. A pedagogical approach to the topic. Analysis of Engineering Structures and Material Behavior is suitable as a textbook for structural analysis and mechanics courses in structural, civil and mechanical engineering, as well as a valuable guide for practicing engineers.

**Applied Mechanics Reviews** - 1991

**Automation in Fatigue and Fracture** - C. Amzallag 1994

**Ceramic Matrix Composites** - Krishan K.

Chawla 2013-03-14 Materials science and engineering (MS&E) is by its very nature an inter disciplinary activity. Researchers from a wide variety of disciplines, metallurgy, ceramics, physics, chemistry, mechanics, electrical and electronic engineering, etc. can and do participate in the MS&E activities. The need and desirability of such an interdisciplinary effort is understandable inasmuch as advanced or high-performance materials are critical for any of the modern industries. It is almost a given axiom that progress in any field (energy, building materials, transportation, electronics, aerospace, electric power, consumer products, etc.) depends on the availability of suitable In this regard, let me quote from materials having specific characteristics. another work of mine: It is a truism that technological development depends on advances in the field of materials. One does not have to be an expert to realize that a most advanced turbine or aircraft design is of no use if adequate materials to bear the service loads and
conditions are not available. Whatever the field may be, the final limitation on advancement depends on materials [1]. It is pertinent to quote from some other sources about a fundamental change that is occurring in the materials field: A fundamental reversal in the relationship between human beings and materials [has occurred]. Its economic consequences are likely to be profound. Historically humans have adapted such natural materials as stone, wood, clay, vegetable fiber and animal tissue to economic uses.

**Mechanical Behavior of Concrete**-Jean-Michel Torrenti 2013-03-01 This title provides a comprehensive overview of all aspects of the mechanical behavior of concrete, including such features as its elastoplasticity, its compressive and tensile strength, its behavior over time (including creep and shrinkage, cracking and fatigue) as well as modeling techniques and its response to various stimuli. As such, it will be required reading for anyone wishing to increase their knowledge in this area.

**21st Annual Conference on Composites, Advanced Ceramics, Materials, and Structures** - A-J. P. Singh 2009-09-28 This volume is part of the Ceramic Engineering and Science Proceeding (CESP) series. This series contains a collection of papers dealing with issues in both traditional ceramics (i.e., glass, whitewares, refractories, and porcelain enamel) and advanced ceramics. Topics covered in the area of advanced ceramic include bioceramics, nanomaterials, composites, solid oxide fuel cells, mechanical properties and structural design, advanced ceramic coatings, ceramic armor, porous ceramics, and more.

**Fatigue and Fracture of Non-metallic Materials and Structures**-Andrea Spagnoli 2020-06-23 The mechanics of fracture and fatigue have produced a huge body of research work in relation to
applications to metal materials and structures. However, a variety of non-metallic materials (e.g., concrete and cementitious composites, rocks, glass, ceramics, bituminous mixtures, composites, polymers, rubber and soft matter, bones and biological materials, and advanced and multifunctional materials) have received relatively less attention, despite their attractiveness for a large spectrum of applications related to the components and structures of diverse engineering branches, applied sciences and architecture, and to the load-carrying systems of biological organisms. This book covers the broad topic of structural integrity of non-metallic materials, considering the modelling, assessment, and reliability of structural elements of any scale. Original contributions from engineers, mechanical materials scientists, computer scientists, physicists, chemists, and mathematicians are presented, applying both experimental and theoretical approaches.


Handbook of Fatigue Crack Propagation in Metallic Structures-A. Carpinteri 2012-12-02 The purpose of this Handbook is to provide a review of the knowledge and experiences in the field of fatigue fracture mechanics. It is well-known that engineering structures can fail due to cyclic loading. For instance, a cyclically time-varying loading reduces the structure strength and can provoke a fatigue failure consisting of three stages: (a) crack initiation (b) crack propagation and (c) catastrophic failure. Since last century many scientists have
tried to understand the reasons for the above-mentioned failures and how to prevent them. This Handbook contains valuable contributions from leading experts within the international scientific community and covers many of the important problems associated with the fatigue phenomena in civil, mechanical, and nuclear engineering.

**Sustainable Bridge Structures**

Khaled Mahmoud
2015-08-07

The ever-increasing traffic demands, coupled with deteriorating condition of bridge structures, present great challenges for maintaining a healthy transportation network. The challenges encompass a wide range of economic, environmental, and social constraints that go beyond the technical boundaries of bridge engineering. Those constraints compound

**Fiber, Matrix, and Interface Properties**

Christopher J. Spragg 1996

Emphasizing fiber-matrix adhesion and its characterization in composite materials, reports results from applying the most commonly used test methods, such as fragmentation, pull-out, and indentation, to high-performance composites and their constituents. The 13 papers were presented at a symposium i

**Magnesium Technology 2020**

J. Brian Jordon
2020-01-22

The Magnesium Technology Symposium, the event on which this collection is based, is one of the largest yearly gatherings of magnesium specialists in the world. Papers represent all aspects of the field, ranging from primary production to applications to recycling. Moreover, papers explore everything from basic research findings to industrialization. Magnesium Technology 2020 covers a broad spectrum of current topics, including alloys and their properties; cast products and processing; wrought products and processing; forming, joining, and machining; corrosion and
surface finishing; and structural applications. In addition, there is coverage of new and emerging applications.

Nuclear Science Abstracts-1975-12


Monotonic, Creep-Rupture, and Fatigue Behavior of Carbon Fiber Reinforced Silicon Carbide (C/SiC) at an Elevated Temperature-John Mark Engesser 2004-03-01 The main objective of this research effort was to examine the impact that cyclic loading frequency has on the life of a C/SiC composite at an elevated temperature of 550 C. Cyclic loading of C/SiC was investigated at frequencies of 375 Hz, 10 Hz, 1 Hz, and 0.1 Hz. Creep-Rupture tests and tests that were combinations of creep-rupture and fatigue were also accomplished. A monotonic tensile test was performed at 550 C and compared to a room temperature monotonic test. This study showed that an elevated temperature of 550 C has very little effect on the Ultimate Tensile Strength (UTS) of C/SiC. The UTS of C/SiC at 550 C was 487 MPa, while the room temperature UTS is 493 MPa. The three creep-rupture tests in this study performed at 350 MPa, 175 MPa and 105 MPa had lives of less than 11 hours despite the fact that the UTS of C/SiC is 487 MPa at 550 C. The short life of the specimens is due to the oxidation of the carbon fibers within the C/SiC composite. S-N curves developed from the fatigue tests indicate that there is an increase in cycles to failure as the frequency is increased. Another important discovery in this study was the fact that oxidation of the carbon fibers within C/SiC is reduced when frequency of fatigue is increased. At high frequency fatigue (10Hz to 375 Hz), C/SiC composites have longer cycle lives and time lives than at low cycle
fatigue. Microscopic and SEM analysis verified that oxidation of carbon within C/SiC is slowed as frequency of fatigue is increased.

**16th Annual Conference on Composites and Advanced Ceramic Materials, Part 2**

- John B. Wachtman
- 2009-09-28

This volume is part of the Ceramic Engineering and Science Proceeding (CESP) series. This series contains a collection of papers dealing with issues in both traditional ceramics (i.e., glass, whitewares, refractories, and porcelain enamel) and advanced ceramics. Topics covered in the area of advanced ceramic include bioceramics, nanomaterials, composites, solid oxide fuel cells, mechanical properties and structural design, advanced ceramic coatings, ceramic armor, porous ceramics, and more.

**Experimental and Applied Mechanics, Volume 6**

- Tom Proulx
- 2011-06-01


**Metal Matrix Composites**

- International Conference on Composite Materials 1993

- M., Bannister
- 1993-09-27

Zirconia V drew 122 contributions from 19 countries. The papers provide an up-to-date picture of zirconia research and development around the

**Science and Technology of Zirconia**

- V-M., Bannister
- 1993-09-27

Zirconia V
world. There is still considerable interest in the theory and practice of transformation toughening together with the application of zirconia toughening to increasingly more complex composite systems. They also reflect a prominent development of recent years, the resurgence of international interest in the zirconia-based solid oxide fuel cell.

Ceramic Matrix Composites—Narottam P. Bansal 2014-11-24 This book is a comprehensive source of information on various aspects of ceramic matrix composites (CMC). It covers ceramic and carbon fibers; the fiber-matrix interface; processing, properties and industrial applications of various CMC systems; architecture, mechanical behavior at room and elevated temperatures, environmental effects and protective coatings, foreign object damage, modeling, life prediction, integration and joining. Each chapter in the book is written by specialists and internationally renowned researchers in the field. This book will provide state-of-the-art information on different aspects of CMCs. The book will be directed to researchers working in industry, academia, and national laboratories with interest and professional competence on CMCs. The book will also be useful to senior year and graduate students pursuing degrees in ceramic science and engineering, materials science and engineering, aeronautical, mechanical, and civil or aerospace engineering. Presents recent advances, new approaches and discusses new issues in the field, such as foreign object damage, life predictions, multiscale modeling based on probabilistic approaches, etc. Caters to the increasing interest in the application of ceramic matrix composites (CMC) materials in areas as diverse as aerospace, transport, energy, nuclear, and environment. CMCs are considered as enabling technology for advanced aeropropulsion, space propulsion, space power, aerospace vehicles, space
structures, as well as nuclear and chemical industries. Offers detailed descriptions of ceramic and carbon fibers; fiber-matrix interface; processing, properties and industrial applications of various CMC systems; architecture, mechanical behavior at room and elevated temperatures, environmental effects and protective coatings, foreign object damage, modeling, life prediction, integration/joining.

Fatigue and Fracture of Traditional and Advanced Structural Alloys-Filippo Berto 2021-04-01 The fatigue behavior of traditional and advanced materials is a very relevant topic in different strategic applications impacting and affecting our daily lives. The present Special Issue invites papers to update readers on the state of the art on this important topic. Both review and original manuscripts are welcome. Special attention will be dedicated to innovative materials and innovative manufacturing processes or post-treatments able to improve the fatigue life and reliability of a structural component. Scale effect will be also fully treated focusing on different applications and multiscale approaches aimed at understanding structural integrity under cyclic loadings. This state of the art perspective will help engineers, designers and people from the academy gain an updated view on this very challenging topic which is nowadays very important due to the advances in manufacturing technologies that allow complex new materials to be fabricated.

UHMWPE Biomaterials Handbook-Steven M. Kurtz 2015-09-16 UHMWPE Biomaterials Handbook, Third Edition, describes the science, development, properties, and application of ultra-high molecular weight polyethylene (UHMWPE) used in artificial joints. UHMWPE is now the material of choice for joint replacements, and is increasingly being used in fibers for sutures. This book is a one-stop reference for information on this advanced
material, covering both introductory topics and the most advanced developments. The third edition adds six new chapters on a range of topics, including the latest in antioxidant technologies for stabilizing HXLPE and up-to-date systematic reviews of the clinical literature for HXLPE in hips and knees. The book chronicles the rise and fall of all-metal hip implants, as well as the increased use of ceramic biomaterials and UHMWPE for this application. This book also brings orthopedic researchers and practitioners up to date on the stabilization of UHMWPE with antioxidants, as well as the choices of antioxidant available for practitioners. The book also thoroughly assesses the clinical performance of HXLPE, as well as alternative bearings in knee replacement and UHMWPE articulations with polyether ether ketone (PEEK). Written and edited by the top experts in the field of UHMWPE, this is the only state-of-the-art reference for professionals, researchers, and clinicians working with this material. The only complete reference for

Intermetallic Matrix Composites-Rahul Mitra
2017-05-25 Intermetallic Matrix Composites: Properties and Applications is a comprehensive guide that studies the types and properties of intermetallic matrix composites, including their processing techniques, characterization and the various testing methods associated with these
composites. In addition, it presents modeling techniques, their strengthening mechanisms and the important area of failure and repair. Advanced/complex IMCs are then explained, such as Self-healing IMCs and laminated intermetallic composites. The book concludes by delving into the industries that use these materials, including the automotive industry. Reviews the latest research in intermetallic matrix composites. Contains a focus on properties and applications. Includes contributions from leading experts in the field.

**Structural Integrity Assessment** - Raghu V. Prakash
2019-07-31

This volume contains selected papers from the Second Quadrennial International Conference on Structural Integrity (ICONS-2018). The papers cover important topics related to structural integrity of critical installations, such as power plants, aircrafts, spacecrafts, defense and civilian components. The focus is on assuring safety of operations with high levels of reliability and structural integrity. This volume will be of interest to plant operators working with safety critical equipment, engineering solution providers, software professionals working on engineering analysis, as well as academics working in the area.

**Comprehensive Hard Materials** - Daniele Mari
2014-02-01

Comprehensive Hard Materials deals with the production, uses and properties of the carbides, nitrides and borides of these metals and those of titanium, as well as tools of ceramics, the superhard boron nitrides and diamond and related compounds. Articles include the technologies of powder production (including their precursor materials), milling, granulation, cold and hot compaction, sintering, hot isostatic pressing, hot-pressing, injection moulding, as well as on the coating technologies for refractory metals, hard metals and hard materials. The characterization, testing, quality assurance and applications are also covered.
Comprehensive Hard Materials provides meaningful insights on materials at the leading edge of technology. It aids continued research and development of these materials and as such it is a critical information resource to academics and industry professionals facing the technological challenges of the future. Hard materials operate at the leading edge of technology, and continued research and development of such materials is critical to meet the technological challenges of the future. Users of this work can improve their knowledge of basic principles and gain a better understanding of process/structure/property relationships. With the convergence of nanotechnology, coating techniques, and functionally graded materials to the cognitive science of cemented carbides, cermets, advanced ceramics, super-hard materials and composites, it is evident that the full potential of this class of materials is far from exhausted. This work unites these important areas of research and will provide useful insights to users through its extensive cross-referencing and thematic presentation. To link academic to industrial usage of hard materials and vice versa, this work deals with the production, uses and properties of the carbides, nitrides and borides of these metals and those of titanium, as well as tools of ceramics, the superhard boron nitrides and diamond and related compounds.

Sensors and Sensing in Biology and Engineering-
Friedrich G. Barth 2012-12-06
Biological sensors are usually remarkably small, sensitive and efficient. It is highly desirable to design corresponding artificial sensors for scientific, industrial and commercial purposes. This book is designed to fill an urgent need for interdisciplinary exchange between biologists studying sensors in the natural world and engineers and physical scientists developing artificial sensors. The main topics cover mechanical sensors, e.g. waves and sounds, visual sensors and vision and...
chemosensors. Readers will obtain a fuller understanding of the nature and performance of natural sensors as well as enhanced appreciation for the current status and the potential applicability of artificial microsensors.