

Table of Contents

Preface

Testing and Characterization of Ceramic Thermal Barrier Coatings	
M. Bartsch, B. Baufeld, S. Dalkılıç and I. Mircea	3
Optimisation of FGM TBC and Their Thermal Cycling Stability	
M.M. Gasik, A. Kawasaki and Y.S. Kang	9
Design and Fabrication of ZrO₂/Stainless Steel Thermal Barrier Coating FGM	
C.C. Ge, W.B. Cao, Z.J. Zhou and Z.H. Chen	15
Advanced High Temperature Turbine Seals Materials and Designs	
W. Smarsly, N. Zheng, C.S. Buchheim, C. Nindel, C. Silvestro, D. Sporer, M. Tuffts, K. Schreiber, C. Langlade-Bomba, O. Andersen, H. Goehler, N.J. Simms and G.M. McColvin	21
Electrically Conductive and Wear Resistant Si₃N₄-Based Composites with TiC_{0.5}N_{0.5} Particles for Electrical Discharge Machining	
D. Jiang, J. Vleugels, O. Van der Biest, W.D. Liu, R. Verheyen and B. Lauwers	27
Wear Mechanisms in Functionally Graded Aluminium Matrix Composites: Effect of the Presence of an Aqueous Solution	
J.R. Gomes, A.R. Ribeiro, A.C. Vieira, A.S. Miranda and L.A. Rocha	33
Functional and Structural Characteristics of Metallic Foams Produced by the SlipReactionFoamSintering (SRFS)-Process	
S. Angel, W. Bleck, S. Harksen and P.-. Scholz	39
The Effect of Grinding Residual Stresses on Contact Loading Strength Degradation in Y-TZP with Different Microstructures	
A. Juy and M. Anglada	47
Electrodeposition of Gradient Layers for Improved Impact Load Resistance	
H. Fauser, C. Poizat, M. Grimm, H. Knoll, W. Schmitt and R. Freudenberger	53
Local Graded Structure in 6.5wt%Si-Fe Alloy and the Effect on Ductility	
Q. Shen, R. Li and L.M. Zhang	59
Functionally Graded TiC-Based Cermets via Combustion Synthesis and Quasi-Isostatic Pressing	
M. Martinez Pacheco, M. Stuivinga, E. Carton and L. Katgerman	63
Fabrication of Al₂O₃-ZrO₂~Ni Functionally Graded Pipes	
H. Kobayashi	69
A New Functional Material; Photonic Fractal	
Y. Miyamoto, S. Kirihara, M.W. Takeda, K. Honda and K. Sakoda	77
Synthesis of Nano ITO Powders Prepared by Solvothermal Process	
S.D. Ahn and S.C. Choi	85
Effective Permittivity of Composite with Core-Shell Type Inclusions by Self-Consistent Method	
Z.J. Peng, P.C. Zhai and Q.J. Zhang	89
Infrared to Visible Upconversion Luminescence in Yb³⁺, Ho³⁺: Y₂O₃ Nanocrystalline Powders	
J. Zhang, S.W. Wang, L.Q. An, M. Liu and L.D. Chen	95
Co-Precipitation Processing of Nanosized (Y,Gd)₂O₃: Eu Powder and Its Enhanced X-Ray Excited Luminescence	
Y. Shi, J.Y. Chen and J.L. Shi	101
Ferroelectric Ceramics Related to BaTiO₃ for Z5U Multilayer Capacitors	
L. Taïbi-Benzia	109
Molecular Organization of Nonlinear Organic Films Laminated by Langmuir-Blodgett Method	
S. Uchida, V.T. Chitnis, H. Furuhashi, T. Yoshikawa, A. Maeda, G. Sawa, K. Kojima, A. Ohashi, S. Ochiai, Y. Uchida, M. Hori and A. Kono	115
Properties of Cu-W Functionally Graded Materials Produced by Segregation and Infiltration	
D. Janković Ilić, J. Fiscina, C.J.R. González-Oliver and F. Mücklich	123

Influence of Dynamic Compaction on Structure and Mechanical Strength of Composite Spinel-Based (LiMn_2O_4, $\text{Li}_4\text{Ti}_5\text{O}_{12}$) Foil Electrodes	129
V. Ivanov, E.M. Kelder, J. Schoonman, A.V. Nikonov, N.M. Pivkin, A.S. Kaygorodov, O.F. Ivanova and A.I. Medvedev	
Recent Development in Nano and Graded Thermoelectric Materials	135
Q.J. Zhang, X.F. Tang, P.C. Zhai, M. Niino and C. Endo	
Thermoelectric Properties of Poly(3-Alkylthiophenes)	141
Y. Shinohara, K. Ohara, H. Nakanishi, Y. Imai and Y. Isoda	
Power Evaluation of PbTe with Continuous Carrier Concentration Gradient	145
Y. Imai, P. Zhu, Y. Isoda and Y. Shinohara	
Development of Thermoelectric Cooling Devices with Graded Structure	151
H. Kohri and I. Shiota	
Multifunctional Applications of Thin Film Li Polymer Battery Cells	157
M.A. Qidwai, J.N. Baucom, J.P. Thomas and D.M. Horner	
Feasibility Study of FGM Technology in Space Solar Power Systems (SSPS)	163
M. Niino, K. Kisara and M. Mori	
Manufacturing of Structured TiO_2-Surfaces for Cell Carrier Application	171
J. Will, I. Gilbert, R. Dittmann, H. Haugen, S. Schnell-Witteczeck and E. Wintermantel	
Effects of the Thermal Residual Stress Field on the Crack Propagation in Graded Alumina/Zirconia Ceramics	177
P. Vena, D. Gastaldi and R. Contro	
Structure of Dental Resin-Based Adhesive Materials	183
L. Fano, V. Fano, W.Y. Ma and X.G. Wang	
Evaluation of Corrosion Resistance of Multi-Layered Ti/Glass-Ceramic Interfaces by Electrochemical Impedance Spectroscopy	189
E.A. Avila and L.A. Rocha	
Development of Multifunctional Materials (MFM): Bioabsorbable Drug-Releasing Hard Tissue Fixation Screws	195
N. Ashammakhi, M. Veiranto, S. Niemelä, J. Tiainen, S. Leinonen, E. Suokas and P. Törmälä	
Neutron Diffraction Studies of Functionally Graded Alumina/Zirconia Ceramics	201
P. Lukáš, M. Vrána, J. Šaroun, V. Ryukhtin, J. Vleugels, G. Anné, O. Van der Biest and M.M. Gasik	
Densification of Step-Graded Al_2O_3-Al_2O_3/ZrO_2 Composites	207
S. Novak and S. Beranič Klopčič	
Electrophoretic Deposition as a Novel Near Net Shaping Technique for Functionally Graded Biomaterials	213
G. Anné, K. Vanmeensel, J. Vleugels and O. Van der Biest	
Degradable, Multifunctional Polymeric Biomaterials with Shape-Memory	219
A. Lendlein and S. Kelch	
Micro-Arc Nitriding of Titanium Surface	225
K. Matsuura, H. Arita, T. Ohmi, M. Kudoh and Y. Miyamoto	
Micro-Structural Characterization and Stress-Corrosion Cracking Behavior of a FGM Glass-Based Coating on Ti6Al4V for Biomedical Applications	229
J. Pavón, M. Caillate, E. Jiménez-Piqué, M. Anglada, S. López-Estebar, E. Saiz and A.P. Tomsia	
A Process for Sintering of Diopside Prepared from Dolomite	235
S. Zouai, F.Z. Mezahi, S. Achour and A. Harabi	
Effect of Stabilised ZrO_2, Al_2O_3 and TiO_2 on Sintering of Hydroxyapatite	241
F.Z. Mezahi, A. Harabi, S. Zouai, S. Achour and D. Bernache-Assollant	
Development of Multifunctional NO_x-Catalysts and -Sensors	249
B. Saruhan and M. Stranzenbach	
The Use of Functionally Graded Poly-SiGe Layers for MEMS Applications	255
A. Witvrouw and A. Mehta	
Full Form of the Near Tip Field for the Interface Crack between a Piezoelectric Material and a Thin Electrode	261
C. Häusler and H. Balke	
Head-On Immobilization of DNA Fragments on CVD-Diamond Layers	267
S. Wenmackers, P. Christiaens, W. Deferme, M. Daenen, K. Haenen, M. Nesládek, P. Wagner, V. Vermeeren, L. Michiels, M. Van de Ven, M. Ameloot, J. Wouters, L. Naelaerts and Z. Mekhalif	

Stacking of Bi₂Te₃ and FeSi₂ for Thermoelectric Applications	273
C. Drasar and E. Müller	
Control of Grading Structure and Thermal Conductivity of Wood by Compressing Process	281
Y. Obata, K. Takeuchi, K. Akaeda and K. Kanayama	
Effects of Seeding on the Formation of Large NaX Zeolite Crystals	287
I.J. Kim and H.J. Lee	
Mechanical Properties of TiO₂-Kaolin FGM Produced by Progressive Lamination Method for NO_x Reduction	293
Y. Uchida, S. Higa, Y. Uchida and N. Hayashi	
Ceramic Foams Coated with Zeolite Crystals	299
F.M.M. Snijkers, S. Mullens, A. Buekenhoudt, J. Luyten and W. Vandermeulen	
Corrosion Resistance of Homogeneous and FGM Coatings	305
M. Malinina, T. Sammi and M.M. Gasik	
TiO₂ Based Films Prepared by Sol-Gel Method for Advanced Water Treatment	311
A. Barau, M. Crișan, M. Gartner, V. Danciu, V. Cosoveanu, I. Marian, M. Anastasescu and M. Zaharescu	
Synthesis and Characterization of NaX Molecular Sieve Zeolite Films on Ceramic Paper for Membranes	317
H.J. Lee, H.C. Kim and I.J. Kim	
Effects of Annealing Condition on the Preparation of Indium-Tin Oxide (ITO) Thin Films via Sol-Gel Spin Coating Process	325
H. Han, Y.H. Yun and S.C. Choi	
The Synthesis of Indium Tin Oxide Nano – Powders by Solvothermal Process	331
J.S. Lee and S.C. Choi	
Indentation of AlN/CrN Multilayers from Room Temperature to 400 °C	335
F. Giuliani, A. Goruppa, S.J. Lloyd, D. Teer and W.J. Clegg	
Fabrication of Nanostructure Composites in Functionally Graded Coatings with Supersonic Free-Jet PVD	341
A. Yumoto, T. Yamamoto, F. Hiroki, I. Shiota and N. Niwa	
Functionally Graded Coatings of Carbon Reinforced Carbon by Physical and Chemical Vapour Deposition (PVD and CVD)	347
K. Maile, K. Berreth and A. Lyutovich	
Interaction between Ti-6%Al-4%V Alloys and Hardmetals Coated by Cathodic-Arc Technology	353
C.M. Moreno, G. Artola and J.M. Sanchez	
New Multifunctional FGM Coatings Produced Using ESA and TRESS Methods	359
A.E. Kudryashov, E.I. Zamulaeva, P.V. Vakaev, Y.S. Pogozhev and E.A. Levashov	
A Simple Galerkin Boundary Element Method for Three-Dimensional Crack Problems in Functionally Graded Materials	367
G.H. Paulino and A. Sutradhar	
Three Dimensional Fracture Analysis of FGM Coatings	373
O. Inan, S. Dag and F. Erdogan	
Time-Dependent Behavior and Fracture of Functionally Graded Thermal Barrier Coatings under Thermal Shock	379
K. Kokini and S.V. Rangaraj	
Fracture Analysis of Functionally Graded Thermal Barrier Coating with Interface Crack by Computational Micromechanics Method	385
S.Y. Yang, L.S. Liu and Q.J. Zhang	
A Multiscale Framework for Elastic Deformation of Functionally Graded Composites	391
H.M. Yin, L.Z. Sun and G.H. Paulino	
Interaction between an Embedded Crack and an Interface Crack in Nonhomogeneous Coating System	397
E.E. Theotokoglou and G.H. Paulino	
On Accurate Numerical Evaluation of Stress Intensity Factors and T-Stress in Functionally Graded Materials	403
J.H. Kim and G.H. Paulino	
Mixed-Mode Crack Propagation in Functionally Graded Materials	409
J.H. Kim and G.H. Paulino	

Machining FGM: Residual Stresses Redistribution	415
B.S. Zhang and M.M. Gasik	
Finite Element Simulation of Microstresses in a Traditional FGM: The Case of Soft Tribological Alloys	
R. Schouwenaars, V.H. Jacobo, S.M. Cerrud and A. Ortiz	421
Thermo-Mechanical Analysis of RLV Thrust Cell Liners with Homogeneous and Graded Coatings	
D.T. Butler, M. Pindera and J. Aboudi	429
Design of Functionally Graded Structures Using Topology Optimization	
G.H. Paulino and E.C.N. Silva	435
Optimization of Material Composition of FGM Coating under Steady Heat Flux Loading by Micro-Genetic Algorithms	
J.P. Wang, G. Chen and P.C. Zhai	441
Dynamic Fracture of Functionally Graded Composites Using an Intrinsic Cohesive Zone Model	
G.H. Paulino and Z.Y. Zhang	447
The Optimization of Propagation Characteristic of Elastic Wave in FGM	
L.S. Liu, Q.J. Zhang and P.C. Zhai	453
Numerical Simulation of a Centrifugal Process to Fabricate Permittivity Graded FGM from Alumina/Epoxy Mixture	
S. Tsuru, N. Hayashi, T. Onoda, Y. Sakamoto and M. Hara	459
Numerical Simulation of Laser Induced Modification Processes of Ceramic Substrates	
M. Rohde, O. Baldus, D. Dimitrova and S. Schreck	465
Design Model and Prediction Model on Preparation of Functionally Graded Material by Co-Sedimentation	
Z.G. Zhou, L.M. Zhang, Q. Shen and D.R. Gong	471
Stress Analysis of Powder Compacts with Graded Structures in Sintering Process	
K. Shinagawa and Y. Hirashima	477
Computer-Integrated Safe Design of FGM Component for Hip Replacement Prosthesis	
B.S. Zhang, M.M. Gasik, A. Facchini, M. Pressacco, P. DallaPria and S. Posocco	483
Optimal Design of Graded Materials in 3-D Heat Transfer	
A. Donoso	489
Creep Response of Ceramic/Metal Functionally Graded Thermal Barrier Coating	
J.P. Wang, S.Y. Yang and L.S. Liu	495
Fabrication of Permittivity Graded Epoxy Resin with Non-Uniform Dispersion of Alumina Fillers by a Centrifugal Procedure	
N. Hayashi, T. Onoda, Y. Sakamoto, S. Tsuru, T. Kawabe and M. Hara	501
Modeling of Segmented Peltier Cooling with Discrete and Continuous Concentration Function	
S. Walczak, W. Seifert and E. Müller	507
The Propagation Characteristic of Viscous-Plastic Wave in Functionally Graded Layer	
L.S. Liu, Q.J. Zhang, P.C. Zhai and C.C. Zhu	517
Thermodynamics and Microstructure of Co-V₈C₇ Alloy	
S.G. Huang, L. Li, J. Vleugels and O. Van der Biest	523
Tribolayer Formation as a Functionally Self-Grading Process in Soft Anti-Friction Alloys	
R. Schouwenaars, V.H. Jacobo, S.M. Cerrud and A. Ortiz	531
Precipitation in Plasma Nitrided Fe-M(M=Ti, V, Al) Alloys	
G. Miyamoto, Y. Tomio, T. Furuhsara and T. Maki	539
Appraisal of Creep Properties of 12Cr1MoV Steel by Small Punch Creep Test Method	
G. Chen, P.C. Zhai and A. Shao	545
Effective Thermal Conductivity of MoSi₂/SiC Composites	
G.Z. Bai, W. Jiang, G. Wang, L.D. Chen and X. Shi	551
The Correlation between Hardness and Yield Strength of Hard Materials	
L. Vandeperre and W.J. Clegg	555
Using the Image Analysis Program for Prediction of Thermal Stability Behavior of Refractory Specimen	
T. Volkov-Husović, R.M. Jančić and D. Mitraković	561

Thermal Transport Properties of Stainless Steel/Zirconia Compacts as a Function of Composition and Temperature	567
L. Hälldahl and M. Nygren	
Fracture and Fatigue Crack Propagation in Graded Composites	573
M. Tilbrook, L. Rutgers, R.J. Moon and M. Hoffman	
Strength Distributions in Ceramic Laminates	581
J. Pascual, F. Chalvet, T. Lube and G. de Portu	
Seebeck Scanning Microprobe for Thermoelectric FGM	587
D. Platzek, G. Karpinski, C. Drasar and E. Müller	
Investigation of Nano-Size TiO₂ Powders: Structure and Particle Size Aspects	593
H.M. Lim, H. Ji, Y.S. Lee, S.J. Kim, H.S. Lee and D. Cho	
Creep Property of Functionally Graded Materials	599
P.C. Zhai, G. Chen and Q.J. Zhang	
Fabrication and Mechanical Properties of TZ-3Y20A /Mo Multilayer Composites	605
L.M. Zhang, L.C. Yu, D.R. Gong and Q. Shen	
Particle Distribution and Orientation in Al-Al₃Zr and Al-Al₃Ti FGMs Produced by the Centrifugal Method	609
P.D. Sequeira, Y. Watanabe and L.A. Rocha	
Regularities of Composite Materials with Micrograded Grain Structure Formation	615
V.V. Kurbatkina and E.A. Levashov	
Evaluation of SiC-Particle Connectivity in Functionally Graded Al/SiC_p Composites by Synchrotron Radiation Holographic Microtomography	621
A. Velhinho, G. Vignoles, P. Cloetens, X. Thibault, E. Boller, F.M. Braz Fernandes, L.A. Rocha and J.D. Botas	
Electron-Probe Microanalysis: Some Revelations in the Investigation of Defects in Steel Products	627
A. Ray	
Certified Reference Materials for the Characterisation of Multifunctional Materials	635
G. Roebben, U. Wätjen and A. Lamberty	
Stress Relaxation on Polished Cross-Sections of Al₂O₃/ZrO₂ FGM Discs Measured by Raman Spectroscopy	641
G. Anné, K. Vanmeensel, J. Vleugels and O. Van der Biest	
Experimental Characterization and Computational Simulation of Glass-Alumina Functionally Graded Surfaces	647
V. Cannillo, T. Manfredini, M. Montorsi, C. Siligardi and A. Sola	
Determining the Elastic Moduli of the Individual Component Layers of Cylindrical Thermal Barrier Coatings by Means of a Mixed Numerical - Experimental Technique	653
T. Lauwagie, K. Lambrinou, I. Mircea, M. Bartsch, W. Heylen and O. Van der Biest	
Polyimide Surface Modification by Low Energy Ion Beam Irradiation	659
W.J. Lee, Y.S. Lee, S.K. Rha, K.Y. Lim, H.S. Lee and C.N. Whang	
Microstructure of Al₂O₃-Fe FGM Obtained by Modified Slip-Casting Method	665
A. Ozieblo, T. Wejrzanowski, K. Konopka, M. Szafran and K.J. Kurzydlowski	
Layered Boron Carbide-Aluminum Composites with Large Changes in Microstructure	673
H.J. Kim, K.P. Trumble and K.J. Bowman	
Steel Parts with Tailored Material Gradients by 3D-Printing Using Nano-Particulate Ink	679
D. Godlinski and S. Morvan	
Combustion Synthesis of Dense Functionally Graded B₄C Reinforced Composites	685
I. Zlotnikov, I. Gotman, L. Klinger and E.Y. Gutmanas	
Formation of Compositional Gradient during Fabrication of FGMs by a Centrifugal In Situ Method	693
Y. Watanabe, S. Oike and I.S. Kim	
Toughness Enhancement of Al₂O₃/Ce-TZP Functionally Graded Materials by Annealing in Inert Atmosphere	699
J. Vleugels, C. Zhao and O. Van der Biest	
Processing of a Graded Ceramic Cutting Tool in the Al₂O₃-ZrO₂-Ti(C,N) System by Electrophoretic Deposition	705
K. Vanmeensel, G. Anné, D. Jiang, J. Vleugels and O. Van der Biest	

Development of Square-Shaped Large-Size WC/Co/Ni System FGM Fabricated by Spark Plasma Sintering (SPS) Method and Its Industrial Applications	711
M. Tokita	
Strong Localization of Electromagnetic Wave in Epoxy/Ceramic Photonic Fractals with Mengersponge Structure Fabricated by Stereolithography	719
S. Kirihara, M.W. Takeda, K. Sakoda, K. Honda and Y. Miyamoto	
Sintering Behavior of Multimodal Ceria Powder Mixtures for Fuel Cell Applications	725
G. Falk, N. Böhm, M. Wolff and R. Clasen	
Synthesis and Characterization of Large NaX Zeolite Crystals by Continuous Crystallization	731
H.J. Lee, H.M. Lim and I.J. Kim	
Graded Microstructure at Fiber / Copper Matrix Interface in FRM Fabricated by the Reaction at Narrow Holes Method	737
Y. Tanaka, T. Goto and Y. Watanabe	
Effect of Microwave Heating on the Synthesis of Layered Double Hydroxide	743
H.M. Lim, M.R. Kang, S.C. Lee, S.H. Lee and K.J. Kim	
Preparing 3D Functional Gradients for SLS	749
S.F. Yang and J.R.G. Evans	
Fabrication and Characterization of Porous Alumina Tube with Pore Gradient	755
C.H. Chen, K. Takita, S. Ishiguro, S. Honda and H. Awaji	
Technology of Low Cost Production of FGMs	761
K. Kisara, M. Niino and H. Noguchi	
Porous Graded Materials by Stacked Metal Powder Hot-Press Moulding	765
K. Nishiyabu, S. Matsuzaki, K. Okubo, M. Ishida and S. Tanaka	
Joining of OFC to TC4 and Structural Control of Joint Interface	771
C.B. Wang, L.M. Zhang and Q. Shen	
Suspension Development for Colloidal Shaping of Al_2O_3-ZrO_2 FGMs	777
A.M. Popa, G. Anné, J. Vleugels, A. Foissy and O. Van der Biest	
Influence of Al_2O_3 Addition on the Microstructure and Mechanical Properties of Pressureless Sintered Ce-TZP	783
S.G. Huang, L. Li, J. Vleugels, P.L. Wang and O. Van der Biest	