



Ceramic
Transactions
Volume 83

Ceramic Processing Science

Edited by

Gary L. Messing

The Pennsylvania State University

Fred F. Lange

University of California at Santa Barbara

Shin-ichi Hirano

Nagoya University

Published by

The American Ceramic Society

735 Ceramic Place

Westerville, Ohio 43081

Contents

Preface.....	xv
--------------	----

Ceramic Synthesis

Synthesis of Nanoceramics with Polymers.....	3
S. Hirano	
The Structure and Surface Properties of Hydrolysates Derived from Chemically Modified Titanium Alkoxides.....	5
P.A. Venz, J.L. Woolfrey, J.R. Bartlett, and R.L. Frost	
Preparing Superfine TiO₂ of PTC Ceramics by Hydrolysis.....	13
Z. Ling, Z. Jiao-shen, L. Qi-rong, and Z. Wei	
Enzymatically Assisted Homogeneous Precipitation of Alumina Precursors.....	15
H. Unuma, S. Kato, T. Ota, and M. Takahashi	
Morphological Development and Modeling During Aerosol Generation of ZnO.....	17
O. Milosevic, M. Mirkovic, J. Vodnik, N.G. Nakazey, and T.V. Tomila	
Synthesis of Nanoparticle ZnO Powders by Controlled Precipitation.....	19
J.E. Rodríguez-Páez, A.C. Caballero, M. Ocaña, C. Moure, P. Durán, and J.F. Fernández	
Synthesis and Characterization of Dense, Monolithic Gel Derived by Sol-Gel Method.....	27
H. Matsuda, T. Kobayashi, M. Kuwabara, H. Shimooka, and S. Takahashi	
Hydrothermal Synthesis and Formation Mechanisms of Shape Anisotropic BaTiO₃ Particles.....	35
F. Dogan	
Theoretically Dense and Nanostructured Ceramics by Low-Temperature Pressureless Sintering of Nanosized Y-TZP Powders.....	43
P. Durán, M. Villegas, J.F. Fernández, F. Capel, and C. Moure	

Enhanced Crystallization Kinetics of Air-Calcined Yttrium Doped Hydrous Zirconia by Seeding	45
J. Tartaj, P. Durán, J.F. Fernández, and C. Moure	
Processing of LiMn_2O_4 Powders by Precursor Method	53
Y.H. Ikihara, Y. Iwamoto, K. Kikuta, and S. Hirano	
Nonoxide Ceramics from Polymers and Gels	61
R. Riedel	
[Si-Ti-Y-O-N] Multicomponent Ceramics Derived from Polymeric Precursors	63
Y. Iwamoto, K. Kikuta, and S. Hirano	
Synthesis of Inorganic-Organic Hybrids from Metal Alkoxides and Phenyltriethoxysilane	71
I. Yoshinaga, N. Yamada, and S. Katayama	
Composites in the Ti-Si-C System	73
C.-S. Park, F. Zheng, S. Salamone, and R. Bordia	
Aluminum Modified Polysilazane Precursors for Si-C-N Ceramics	75
B. Bauer and B. Derby	
Processing of Silicon Carbide Ceramics Using Chemically Modified Polycarbosilane Containing Fluoroalkoxy Groups as Binder.	77
Y. Iwamoto, S. Okuzaki, K. Kikuta, and S. Hirano	
Structural Characterization of New Ternary Transition Metal Nitrides Synthesized by the Ammonolysis of Complexed Metallorganic Precursors.	83
K.S. Weil, P.N. Kumta, and J. Grins	
Phase Selection in Induction Plasma Treatment of Molybdenum Disilicide Powders	91
X. Fan and T. Ishigaki	
Synthesis of $\text{Al}_2\text{O}_3/\text{SiC}$ Powders from Aluminosilicate Precursors	99
C.E. Borsa, F. Spiandorello, and R.H.G.A. Kiminami	
$\text{Al}_2\text{O}_3/\text{SiC}$ Nanocomposites from Alternative Processing Routes	101
C.E. Borsa, R.I. Todd, and R.J. Brook	
 Colloid Dispersion and Consolidation	
Processing Ceramic Dispersions.	111
C.F. Zukoski, G. Channell, and J. Wall	

Dispersion and Stabilization of Very Fine Particle Suspensions	113
J. Widegren and L. Bergström	
Brownian Dynamics View on Coagulation Kinetics in Colloidal Suspensions	115
M. Huetter, L.J. Gauckler, and H.C. Oettinger	
Aggregation Effects on Properties and Processing of Colloidal SiO₂ Suspensions	117
J.A. Lewis and J. Guo	
Relationship Between Rheology and Interparticle Forces in Aqueous BaTiO₃ Systems	119
J. Sindel, M. W. Sigmund, B. Baretzky, and F. Aldinger	
Heterogeneity of Adsorption and Its Impact on Stability of Alumina Suspension with Polyelectrolyte	121
L-C. Guo, Y. Zhang, N. Uchida, and K. Uematsu	
The Rheological Behavior of Slurries and Consolidated Bodies Containing Interpenetrating Networks	123
M.L. Fisher and F.F. Lange	
Influence on the Stabilization Mechanism on the Rheological Characteristics and Slip Casting of Zirconia Suspensions	125
J. Lara-Aguilar and H. Balmori-Ramirez	
Rheology of Aqueous 3Y-ZrO₂ Powder Slurries: Effect of Polyelectrolyte Type and Molecular Weight	127
F. Shojai, T. Mäntylä, A.B.A. Pettersson, and J.B. Rosenholm	
Electrokinetic Behavior and Stability of SiC Nanoparticle Dispersions	129
P. Tartaj and J.S. Moya	
Development of Short-Range Repulsive Interparticle Forces in Aqueous Si₃N₄ Slurries with Chem-Adsorbed Silanes	131
M. Colic, G. Franks, M. Fisher, and F.F. Lange	
Silanol Adsorption and Properties of Si₃N₄	133
J.A. Yanez and W. Sigmund	
Alignment of Nonspherical Particles During Ceramic Processing	135
T.A. Ring	
Rheological Properties of Sepiolite with Nanosize, Fibrous Morphology	137
E. Günay, T. Baykara, and T.O. Oezkan	

Interaction Between Binder and Dispersant in Aqueous Slurry of Alumina	139
T. Nakashima, H. Mizutani, Y. Zhang, N. Uchida, and K. Uematsu	
Thermochemistry of PAA Adsorption on Alumina Surface	147
K. Yamashita, W. Kabutoya, Y. Zhang, N. Uchida, and K. Uematsu	
Quantum Chemical Study of Interactions Between Ceramic Powder Surface and Polymer Additives	155
M. Obata, Y. Zhang, N. Uchida, and K. Uematsu	
Wetting Behavior of Tape Casting Slurries on Polymeric Tape Carriers	163
C. Lutz and A. Roosen	
Microfocus X-ray Images of Aggregates in Aqueous Zirconia Suspensions	171
J.C. Austin, W. Liang, and K. Kendall	
Mechanical Properties of Consolidated Bodies vs. Interparticle Pair Potential	179
F.F. Lange	
Plastic or Brittle? Influence of Coagulation Mechanism on Cracking Behavior of Wet Alumina Green Bodies	181
B. Balzer, M. Widmer, M.K.M. Hruschka, and L.J. Gauckler	
Experiments on Slurry Consolidation Mechanics	183
D.N. Ravishankar and B.J. Kellert	
Computer Simulation of Microstructure and Strength of Settled Colloidal Powders	193
J.C. Kim and D.M. Martin	
Numerical Simulation of Two-Dimensional Cake Growth in a Rectangular Slip Casting System	203
M. Takahashi, J. Shimizu, H. Unuma, and T. Aragaki	
Processing of Nanosized Ceramic Powders—A Bimodal Slip Casting Approach	211
P. Bowen, O. Charvin, H. Hofmann, C. Carry, and C. Hérard	
Fabrication of PZT Thick Film Through Centrifugal Sedimentation Method	219
H. Yamaguchi, M. Itoh, and S. Hirano	
Centrifugal Forming of Pore-Gradient Membranes	229
F. Müller, C.W. Hong, and P. Greil	
Pressure Slip Casting of SiC Aqueous Slips	231
M.I. Nieto, A. Salomoni, I. Stamenkovic, and R. Moreno	

Preparation of a Fine-Grained Zirconia System by Colloidal Processing	233
Y. Sakka, T. Uchikoshi, K. Ozawa, T. S. Suzuki, and K. Hiraga	
“Robocasting”: Direct Fabrication of Ceramics and Composites	241
J. Cesarano III and P. Calvert	
From Colloids to Components	243
L. Gauckler	
Internal Coagulation of Polymer/Ceramic Composites	245
D. Kovacova, T.J. Graule, M.K.M. Hruschka, and L.J. Gauckler	
The Relevance and Reliability of Direct Coagulation Casting (DCC) for Industrial Forming Processes	247
W. Burger, L.J. Gauckler, G. Kiefer, and H. Ziegelbauer	
Microporous Mullite Ceramics by Gel Casting of Alkoxide-Derived Precursor Powder	249
H. Suzuki, M. Shimizu, H. Kamiya, T. Oto, and M. Takahashi	
Gelcasting and Aqueous Injection Molding for Silicon Nitride Structural Ceramics	251
O.O. Omatete and J.P. Pollinger	
Enzyme Catalyzed Gelation of Boehmite Containing Sols	253
J.M. Helbig, Z. Xie, M.K.M. Hruschka, and L.J. Gauckler	
Forming Ceramics with Biopolymers	255
J. Brandt, E. Carlström, A. Kristoffersson, O. Lyckfeldt, and G. Lindsten	
Use of Hydrolysis-Assisted Solidification (HAS) in Slurry Forming Si₃N₄ Bodies	257
K. Krnel and T. Kosmac	
Shaping of Ceramic Bodies from Oxide/Nonoxide Powder Mixtures by Electrophoresis	265
K. Moritz and E. Müller	
The Production of Engineering Ceramic Foams from Aqueous Suspensions	273
J.G.P. Binner, P.A.I. Sepulveda, and R.T. Smith	
Preparation of Shirasu/Alumina Lightweight Composites through a Colloidal Processing	283
Y. Sakka and K. Sodeyama	
Effect of Water Content on Ceramic Forming by Compaction	291
J. Nyumura, Y. Zhang, N. Uchida, and K. Uematsu	

Direct Examination on the Strength Variation of Alumina Powder Granules with Binder Content and Relative Humidity	293
J. Nyumura, Y. Zhang, N. Uchida, and K. Uematsu	
High-Pressure Precompaction for Shape Stabilization of Sintered UO₂ Pellets	301
K. Yanai	
 Films, Coatings, and Fibers	
Chemical Solution Deposition of Electroceramic Thin Layers and Their Patterning by Microcontact Printing with Self-Assembled Monolayers . . .	305
D. Payne, R.G. Nuzzo, P.G. Clem, N.L. Jeon, and D.Y. Jung	
Processing of Ceramic Fine Patterns Using Excimer Lamp	307
K. Kikuta, T. Yogo, and S. Hirano	
Ceramic Thin Films Made by Propionate-Based Chemical Solution Deposition Routes	315
U. Hasenko, S. Hoffmann, and R. Waser	
A Chemical Solution Route for Processing Thin Films of Oxygen Ion-Conducting Bismuth Vanadate	317
S. Simner and B. Dunn	
Formation of Epitaxial PbTiO₃ Islands on LaAlO₃ and SrTiO₃ Substrates by Chemical Solution Deposition	319
J.H. Kim, C.D.E. Lakeman, J.S. Speck, and F.F. Lange	
Chemical Solution Deposition of CMR Epitaxial Thin Films	321
A.D. Polli, F.F. Lange, M. Ahlskog, R. Menon, and A.K. Cheetham	
Processing and Hardness of Epitaxial Alumina Thin Films Containing Nanosized Zirconia Inclusions	323
F. McNally and F.F. Lange	
Growth and Characterization of Tin Oxide Thin Films	325
L. Fu and X. Pan	
Processing Effects on Stoichiometry of Hydrothermally Derived Ba_xSr_{1-x}TiO₃ Powders and Films	327
R.K. Roeder and E.B. Slamovich	
Hydrothermal Synthesis of Pb(Zr_xTi_{1-x})O₃ Powders and Heteroepitaxial Thin Films	329
A.T. Chien, J.H. Kim, Y.S. Yoon, J.S. Speck, and F.F. Lange	
Synthesis of Highly Oriented (Pb_{0.85}La_{0.1})TiO₃ Thin Films by Chemical Solution Deposition Method	331
W. Sakamoto, S. Yada, T. Kohigashi, K. Kikuta, T. Yogo, and S. Hirano	

Evolution of Porous Microstructures in Doped PbTiO₃ Pyroelectric Thin Films	339
A. Seifert, P. Muralt, and N. Setter	
Ultraviolet Ray Shielding Coating on Glass by Sol-Gel Process	341
H. Tomonaga, A. Mitani, and T. Morimoto	
Thin Film Solid Oxide Fuel Cells by Colloidal Processing	349
C. Jacobson, S.J. Visco, and L.C. DeJonghe	
Design and Microstructure Control of Ceramic Laminates by Colloidal Filtration	351
A.J. Sánchez-Herencia and R. Moreno	
Chemical Methods for Processing La-Monazite and Related Compounds for CMC Weak Interfaces	353
P.E.D. Morgan, J.B. Davis, D.B. Marshall, and R.M. Housley	
Design of Layered ZrO₂/Y-TZP Materials for Crack Bifurcation	355
A.J. Sánchez-Herencia and F.F. Lange	
Effects of Stacking Structures on Crystallization and Properties of Multilayer Pb(Zr_xTi_{1-x})O₃ Thin Films	357
H. Suzuki, Y. Kondo, S. Kaneko, and T. Hayashi	
Processing of Silicon Nitride Based Multilayered Composites	359
Y. Shigegaki, M.E. Brito, K. Hirao, M. Toriyama, and S. Kanzaki	
Ceramic Membranes for Nanofilters	367
H. Richter, A. Piorra, and G. Tomandl	
Assessment of the Critical Thickness and Fracture Toughness of Thin Metal-Organic Precursor Films	375
R.K. Roeder and E.B. Slamovich	
Stress Formation during Drying of Porous Media	383
S. Lampenscherf, M. Bobeth, and W. Pompe	
Electrophoretic Deposition of TZP on Porous Substrates	385
J. Will, L. Gubler, S. Al-Wakeel, M. Gödickemeier, M.K.M. Hruschka, and L.J. Gauckler	
Zirconia Coatings onto Nickel Electrodes by Aqueous Electrophoretic Deposition	387
B. Ferrari and R. Moreno	
Patterning Process Using Micrometer Particles	389
H. Fudouzi, M. Kobayashi, and N. Shinya	
Fabrication of Woven Nicalon™ (NL607) SiC Fiber-Yttrium Disilicate CMCs Using Electrophoretic Deposition	391
P.A. Trusty, C.B. Ponton, and A.R. Boccaccini	

Electrophoretic Filtration Deposition (EFD) of Saffil Alumina Fiber-Reinforced Mullite Multilayer Nanoceramic Matrix Composites	399
C. Kaya, P.A. Trusty, and C.B. Ponton	
Synthesis of Al₂O₃/YAG Composite Fibers	407
A. Towata, H.J. Hwang, M. Yasuoka, M. Sando, and K. Niihara	
Spinning of Ceramic Fibers with a Special Structure for Membrane Applications	415
J. Luyten, W. Adriansens, I. Genné, J. Cooymans, and R. Leysen	
Biomorphic Silicon Carbide Ceramics with Cellular Microstructure	425
P. Greil, T. Lifka, and A. Kaindl	
Faster Ceramic Composites via Use of an Inverse Temperature Profile During Chemical Vapor Infiltration	433
J.G.P. Binner and Y. Yin	
 Microstructures of Complex Ceramics	
Phase Selection During Crystallization	445
C.G. Levi	
Evolution and Hierarchy of Crystallization in CaO-P₂O₅-SiO₂-Al₂O₃-TiO₂ Glass-Ceramics	447
S. Jordery, W.E. Lee, and P.F. James	
Low-Temperature Consolidation of Metastable Phases in the Al₂O₃-ZrO₂ Binary System	449
V. Jayaram	
Preparation of Alumina-Chromia Solid Solution Powder and Thin Film through Precursor Method	451
K. Sato, Y. Iwamoto, K. Kikuta, and S. Hirano	
Recrystallization of Alumina by Addition of Ferric Oxide	459
Y.K. Paik, H.Y. Lee, and S.J.L. Kang	
Preparation and Characteristics of Thermally Stabilized Transition Alumina.	461
O. Yamanishi and S. Hamano	
Influence of Fe³⁺ on the Sintering Properties of Calcium Hexaluminate	469
C. Dominiquez and R. Torrecillas	
Forming and Sintering of Alumina with Hydraulic Inorganic Binder . . .	471
T. Nagaoka, K. Kikuta, and S. Hirano	
Synthesis of Fine-Grained Alpha Alumina via Mechanical Seeding.	473
M.L. Panchula and J.Y. Ying	

Mechanical and Functional Properties of TiO₂-Modified Porous α-Al₂O₃ Layers	475
L. Grönroos, T. Mäntylä, A.B.A. Pettersson, and J.B. Rosenholm	
Fracture of Al₂O₃ with Controlled Pores, Effect of Grain Size	477
A. Zimmerman, M. Hoffmann, J. Rödel, R.K. Bordia, and B.D. Flinn	
Processing and Wear Properties of Al₂O₃/AlPO₄-Epoxy Composite Coatings	479
B.D. Craig and L.F. Francis	
Controlled Microstructures in Ni/NiO Composites	481
D. Clayton and D.S. Wilkinson	
Processing and Mechanical Performance of Mullite-Al₂O₃ Functionally Graded Ceramics	483
J.F. Bartolome, J. Requena, and J.S. Moya	
Mechanical and Thermal Properties of Low-Temperature Sintered AlN	485
M. Kasori, H. Sumino, A. Horiguchi, and F. Ueno	
Continuous and Low-Temperature Sintering Additive for Aluminum Nitride	493
A. Horiguchi, M. Kasori, H. Sumino, and F. Ueno	
Controlling Grain Morphology for Si₃N₄ and SiC Microstructures . . .	495
M.J. Hoffmann	
Tailoring Microstructure Development via Templated Grain Growth . . .	497
G.L. Messing, M.M. Seabaugh, and S.-H. Hong	
Characterization of Microstructural Evolution and Texture Development in Templated Liquid Phase Sintered Alumina	503
M.M. Seabaugh, G.L. Messing, M.D. Vaudin, and J.P. Cline	
Single Crystallike High-Temperature Ferroelectrics by a Templated Grain Growth Approach	505
B. Brahmaroutu, G.L. Messing, and S. Trolier-McKinstry	
Microstructure Control of an Oxide Superconductor by Solid State Crystal Growth	507
M. Awano, Y. Kodama, Y. Takao, and Y. Kuwahara	
Microstructural Evolution of Melt-Textured YBa₂Cu₃O_{7-x} Doped with Pt or CeO₂	509
J.D. Reding and F. Dogan	
Anisotropic Ostwald Ripening in α-Si₃N₄ with Different Lanthanide Additives	517
M. Kitayama, K. Hirao, M. Toriyama, and S. Kanzaki	

Preparation, Interface Chemistry, and Mechanical Properties of SiC-Si₃N₄ Nano/Microcomposites	525
P. Sajgalik, K. Rajan, P. Warbichler, F. Hofer, and R. Riedel	
Processing and Mechanical Properties of Highly Anisotropic Si₃N₄	527
H. Imamura, K. Hirao, M. Brito, M. Toriyama, and S. Kanzaki	
Multiphase Composites of Silicon Nitride with Synergic Effect	529
J. Hojo, N. Oyama, K. Kishi, and S. Umabayashi	
Controlling Grain Morphology for Si₃N₄ and SiC Microstructures	531
C. D. Hillman and W.J. Clegg	
Development of Elongated α-SiAlON Grains by Pressureless Sintering	533
C. Wood, H. Zhao, and Y-B. Cheng	
Effect of ZrO₂ Inclusions on the Densification of Al₂O₃ and ZnO Matrix Composites	541
Y. Nakada, M. Itoh, and T. Kimura	
Microstructure and Ionic Conductivity of CaO-Modified CeO₂-Y₂O₃ Solid Solutions Processed by a Solution Precipitation Route	549
C. Moure, M. Villegas, J. Tartaj, and P. Durán	
High-Temperature Hardness and Toughness of MgO Partially Stabilized Zirconia and Y₂O₃ Tetragonal Zirconia Ceramic	557
S. Muneki, F. Abe, and H. Irie	
Sintering Model for Mixed Oxide Derived Lead Zirconate Titanate (PZT) Ceramics	565
M. Hammer and M.J. Hoffmann	
Index	567