May 14, 2021

Rishi Raj

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Professional Preparation

Allahabad University (India)	Pure Sciences	B.Sc.	1961
University of Durham (England)	Elect. Eng.	B.A, (Hons I)	1964
Harvard University (Cambridge, MA)	Eng. & App. Sci.	Ph.D.	1970

Appointments

1996 – now Professor of Mechanical Engineering, University of Colorado Boulder, CO

1975 – 1996 Professor of Materials Science and Engineering, Cornell University, Ithaca, NY

1972 – 1975 Assist. Professor of Mechanical Engineering, University of Colorado Boulder, CO

1971-72 Scientist, Chase Brass and Copper Company, Cleveland, OH

1964-65 Staff Engineer, Standard Telephones and Cables Ltd, London N10, England.

1980 Scientist, Rockwell Science Center, Thousand Oaks, CA

Awards

•2017, Served as Distinguished Visiting Fellow of the Royal Academy of Engineering (UK).

•2015, Elected Distinguished Life Member of the American Ceramic Society – the highest honor conferred upon the Members of the Society;

•2013, Edward C. Henry Best Paper Award, with J-C M'Peko, J.S.C. Francis, "Impedance Spectroscopy and Dielectric Properties of Flash versus Conventionally Sintered Yttria-DopedZirconia Electroceramics viewed at the Microstructural Level", American Ceramic Society.

•2011-2017, Distinguished Chair Professor at POSTECH, Republic of Korea

•2011-2012, Japan Society for Promotion of Science Fellowship to Tokyo Tech, Japan

•2004, Aditya Birla Chair Professor of Mechanical Engineering (an Honorary appointment), Indian Institute of Science, Bangalore, India

•1996, John Matthias Scholar, Los Alamos National Laboratory

•1992, Alexander von Humboldt Senior Scientist Awardee, Max Planck Institute for Metal Research in Stuttgart, Germany

•1985, Guggenheim Fellow

•1964, John Mather and Mauder Howe Prizes from the University of Durham, England

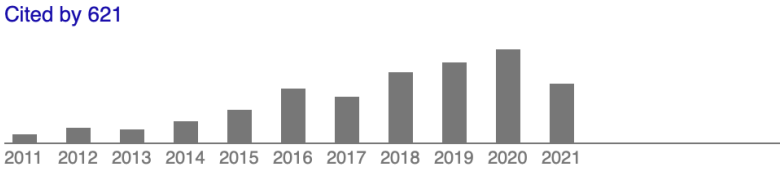
•1961, Gold Medals in Chemistry and Mathematics, Allahabad University, India.

Current Research and Interest

I. Field Assisted Sintering

The Raj group is intensely involved in phenomenological, scientific and technological research in the broad area of field assisted processing of ceramics (and more recently also metals such as tungsten). More specifically it is related to the phenomenon discovered in his laboratory in 2010, which was dubbed flash sintering. Interest in flash sintering has grown and spread to many laboratories throughout the world. Many of these scientists have visited Raj's laboratory and then taken their experience home to continue flash research.

The plot below from Google Scholar (downloaded 05/14/21) shows the growing interest in this field.



Flash Sintering of Nanograin Zirconia in< 5 s at 850 C
M Cologna, B Rashkova, R Raj - Journal of the American Ceramic Society, 2010
Cited by 621 Related articles All 4 versions

Raj has organized two international conferences, held in Tomar, Portugal, under the auspices of ECI, New York, NY; the first in March 2016, the second in March 2019, and the third has just been postponed to March 2022. These conferences have helped to build a community around this fledgling field of research.

Key Developments in Field Assisted Processing

•The generality of Flash Sintering striking; it has been shown to apply to nearly all oxides.

•The latest work called Reactive Flash Sintering is expected to have a huge impact on the speed and innovation in materials discovery and processing. For example, powders of several primitive oxides can be casually mixed and flashed to yield a single phase of a multicomponent ceramic in a few seconds. Compounds not accessible can be made quickly, easily, and in-expensively. Examples are non-stoichiometric oxides which may have unusual properties for ceramic electrolytes and cathode materials in Li+ batteries and fuel cells.

•New states of matter are being discovered. For instance, very recently his group has produced electronically conducting zirconia which is normally a highly ionic oxide. The result has generality and may apply to many oxides. Titanium oxide has similarly been made to be an elecronic conductor. Temperature dependent measurement of resistivity suggest that these are small band gap or zero band gap materials. The future is hard to predict but the possibility of the discovery of novel superconductors is not out of the question.

•Raj has become interested in additive manufacturing of ceramics with microflash sintering for the direct production of work pieces of complex geometry that are dense and sintered as they come off the line (please see the April 2021 issue of the Ceramic Bulletin).

2. Electro-chemo-mechanical studies and new materials for batteries

•Application of reactive flash sintering for the synthesis of ceramics for battery and fuel cell technologies is highly promising. We have already made non-stoichiometric Lithium lanthanum zirconate for ceramic Li+ batteries by RFS with a four fold increase in Li+ conductivity.

•We are making significant contributions in modeling the electro-chemo-mechanical performance of lithium-ion batteries. For example, the stresses generated during stripping and plating of lithium in Li-metal batteries. is being pursued.

3. CMCs for Extreme Environments

Our work on polymer-derived ceramics over the last twenty years is now being applied to create innovation in the design and production of dense CMC structures.

We have been able to overcome the key problem in matrix infiltration of silicon-carbide fiber preforms by the conventional PIP (polymer infiltration and pyrolysis) method which requires several cycles, each lasting several days in an attempt to create a dense matrix.

•An important innovation from our lab has been the infiltration of the fiber preform by a

nanolayer-by-nanolayer additive process. A thin film of the polymer liquid precursor is deposited. It wets the entire surface of the preform. This liquid film is pyrolyzed in just a few seconds. Being thin, this liquid film converts into the ceramic phase without any flaws. Each cycle deposits a thickness of 30 - 50 nm film. The cycles are repeated until the matrix is complete and dense. About 40 to 80 cycles are needed to complete the process which takes about 4 hours. The system has been automated to operate on its own.

•The significant innovation in this layer-by-layer additive process is that chemistries of environmental barrier coatings can be built into the design of the process. We have shown that incorporation of hafnium oxide which evolves into hafnium silicate imparts a remarkable resistance to oxidation in extreme (humid and hot) environments.

The layer-by-layer additive system is ripe for development of new CMC fabrication systems.

Summary of Teaching

For the last three or four years I have been teaching two courses a year. These courses are taken by our first-year graduate students and also by upper-class BS-MS students. They are

A. Mechanical Properties - Materials Science

http://www.rishirajboulder.com/MPMS/

B. Ceramics

http://www.rishirajboulder.com/Ceramics_2020/

Grant Expenditures

Grants from NSF, ONR, ARO

2020: approximately $400,000 per year

2016: $616,538

2015: $873,339

2014: $716,304

2013: $758,833

National and International Service Activities

- American Ceramic Society has named a medal called "Rishi Raj Medal for Innovation and Commercialization". The first award was made in 2020 to Dr. George Beall of Corning Glass Works. Inaugural award summary: **https://www.dropbox.com/sh/f3563ot0mhri2h3/AAAEZHHhIfmrgX4xU6gu0tCta?dl=0&preview=RishiRaj.mp4**
- Conceptualized, Chaired, lobbied for participants and raised funds from ARO and ONR for an Engineering Conference International Conference on "Field Assisted and Flash Sintering" held in Tomar, Portugal, March04-09, 2016, and then again in March 2019. The next meeting will be held in March 2022, and then every three years thereafter.
- Worked with Prof. Gurpreet Singh to enable a PIRE (Partners for International Research and Education Grant) grant from the NSF on Polymer-Derived Ceramic Fibers; a five year, $1M per year grant with participants from US, Germany, Italy, France, India and Japan. Start date: 01/01/2018.
- Founding Organizer of Boulder International Workshops on Polymer Derived Ceramics: 1998, 2000, 2002, 2010, 2012, and 2014: laid the foundation for building a community in a fledging field of research.
- Chair of the Materials Division of ASME, 2001-2002. Executive Committee1997-2002.
- Established a Dual Ph.D. program between Department of Materials and Industrial EngineeringUniversity of Trento, and Mechanical Engineering from the University of Colorado at Boulder.

Mentorship

Raj has supervised the doctoral thesis of more than 60 Ph.D. students, as well as approximately 20 Post- Doctoral Research Associates, and 25 Master's Thesis students. A very large number of undergraduates, about two or three per year for the last 45 years have gained laboratory experience under his guidance.

There are usually, always three or so visitors to his laboratory who come here for extended stays to participate and collaborate in research.

I have also mentored many scientists at different stages in their careers. They become close friends.

Publications

Please the following pages.

References

...upon request.

Paul M. Rady
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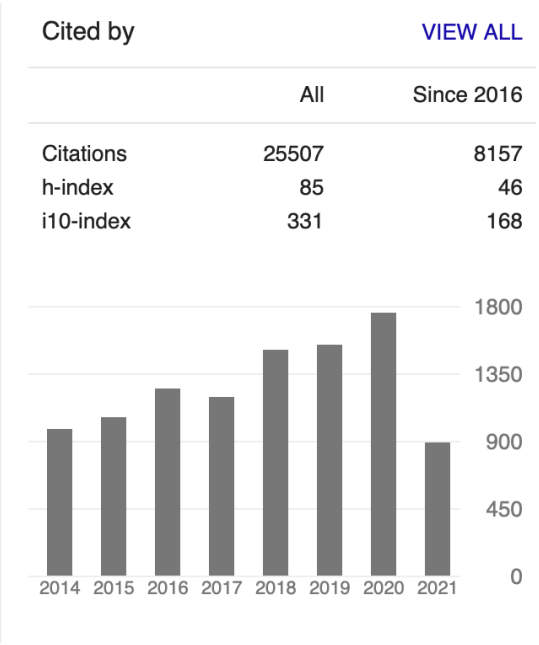
May 14, 2021

The publication list in the following pages represent our work since 1996 (when I moved from Cornell to CU Boulder) until 2021. In most if not all of them I have been actively involved in the preparation of figures and the writing. I believe this to be a good learning experience for those who work with me, in their professional future. Often if there are several authors, I leave the first and the last authorship to the two students who have worked closely together and contributed equally to the outcomes.

The overall metrics downloaded from Google Scholar is printed just below,

Downloaded on 05/14/21



Rishi Raj
Professor of Mechanical Engineering

/over

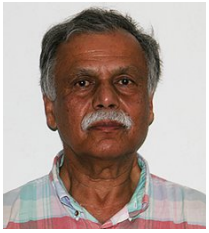
The principal topics of research:

Since 2011	Predominantly related to Flash Sintering
1996-2011	Polymer Derived Ceramics

Moved from Cornell University to CU-Boulder

1990-1996	Thin films of ferroelectric properties*
1980-1990	Constrained sintering
1970-1980	Creep and Fracture at Elevated Temperatures

*Research on Thin Films, which was doing quite well at Cornell had to be abandoned upon moving to Colorado because of the lack of facilities,



Rishi Raj

University of Colorado
/Cornell University

Flash Sintering
Polymer Derived Ceramics

	All	Since 2016
Citations	25408	8118
h-index	85	46
i10-index	329	167

13 articles not available

40 articles available

Based on funding mandates

TITLE	CITED BY	YEAR
Phase evolution during reactive flash sintering of Li6. 25Al0. 25La3Zr2O12 starting from a chemically prepared powder V Avila, B Yoon, S Ghose, R Raj, LM Jesus Journal of the European Ceramic Society 41 (8), 4552-4557		2021
Flash sintering of yttria-stabilized zirconia powders coated with nanoscale films of alumina by atomic layer deposition RJ O'Toole, B Yoon, CJ Gump, R Raj, AW Weimer Journal of the American Ceramic Society 104 (6), 2472-2482		2021
Frenkel pairs cause elastic softening in zirconia: theory and experiments R Kathiria, D Wolf, R Raj, M Jongmanns New Journal of Physics		2021
Influence of flash sintering on phase transformation and conductivity of hydroxyapatite IR Lavagnini, JV Campos, AG Storion, AO Lobo, R Raj, EMJA Pallone Ceramics International 47 (7), 9125-9131		2021
Current constriction of Li-ion transport across lithium metal–ceramic electrolyte interface: Imaged with X-ray Tomography A Badran, T Clemenceau, N Andriamady, D Marshall, R Raj MRS Communications, 1-5		2021
Thin coatings of hafnon abate oxidative recession of SiC fibers S Azarnoush, R Raj Journal of the American Ceramic Society		2021
Flash sintering: A new frontier in defect physics and materials science R Raj, A Kulkarni, JM Lebrun, S Jha MRS Bulletin 46 (1), 36-43	1	2021
Precipitous weakening of quartz at the α–β phase inversion B Lawn, D Marshall, R Raj, G Hirth, T Page, J Yeomans Journal of the American Ceramic Society 104 (1), 23-26	3	2021
Solidification Processing of Magnesium Based In-Situ Metal Matrix Composites by Precursor Approach NC Machavallavan, R Raj, MK Surappa		2020

Magnesium Alloys

Electric field-assisted flash sintering of Bi2/3Cu3Ti4O12 starting from a multi-phase precursor powder LM Jesus, RS Silva, R Raj, JC M'Peko Journal of the European Ceramic Society 40 (12), 4004-4009	1	2020
Current-rate flash sintering of gadolinium doped ceria: Microstructure and Defect generation TP Mishra, RRI Neto, R Raj, O Guillon, M Bram Acta materialia 189, 145-153	14	2020
Reactive flash sintering of the entropy-stabilized oxide Mg0. 2Ni0. 2Co0. 2Cu0. 2Zn0. 2O B Yoon, V Avila, R Raj, LM Jesus Scripta Materialia 181, 48-52	17	2020
Electronic conductivity in gadolinium doped ceria under direct current as a trigger for flash sintering TP Mishra, RRI Neto, G Speranza, A Quaranta, VM Sglavo, R Raj, ... Scripta Materialia 179, 55-60	25	2020
The flash effect in electronic conductors: The case of amorphous carbon fibers RRI Neto, R Raj Scripta Materialia 179, 20-24	3	2020
Method of forming a sintered compound and compound formed using the method R Raj, V Avila US Patent App. 16/136,043		2020
Reactive flash sintering of the complex oxide Li0. 5La0. 5TiO3 starting from an amorphous precursor powder V Avila, B Yoon, RRI Neto, RS Silva, S Ghose, R Raj, LM Jesus Scripta Materialia 176, 78-82	17	2020
Flash-induced spreading of metals on zirconia G Kiniger, V Sglavo, SK Jha, R Raj Scripta Materialia 176, 73-77	2	2020
Processing and properties of $Bi_{0.98}R_{0.02}FeO_3$ (R = La, Sm, Y) ceramics flash sintered at ~650°C in <5 s E Gil-González, A Perejón, PE Sánchez-Jiménez, R Raj, ... Journal of the American Ceramic Society 103 (1), 136-144	3	2020
Transition to electronic conduction at the onset of flash in cubic zirconia S Jo, R Raj Scripta Materialia 174, 29-32	16	2020
Flash sintering of Li-ion conducting ceramic in a few seconds at 850° C T Clemenceau, N Andriamady, PK MK, A Badran, V Avila, K Dahl, ... Scripta Materialia 172, 1-5	10	2019

Reactive flash sintering of powders of four constituents into a single phase of a complex oxide in a few seconds below 700° C V Avila, R Raj Journal of the American Ceramic Society 102 (11), 6443-6448	21	2019
On the role of Debye temperature in the onset of flash in three oxides TP Mishra, V Avila, RRI Neto, M Bram, O Guillon, R Raj Scripta materialia 170, 81-84	30	2019
On the synchronicity of flash sintering and phase transformation B Yoon, D Yadav, S Ghose, P Sarin, R Raj Journal of the American Ceramic Society 102 (6), 3110-3116	16	2019
Flash sintering of ceramic films: The influence of surface to volume ratio V Avila, R Raj Journal of the American Ceramic Society 102 (6), 3063-3069	6	2019
Reactive flash sintering: MgO and α-Al_2O_3 transform and sinter into single-phase polycrystals of $MgAl_2O_4$ B Yoon, D Yadav, S Ghose, R Raj Journal of the American Ceramic Society 102 (5), 2294-2303	29	2019
Influence of flash sintering on the ionic conductivity of 8 mol% yttria stabilized zirconia X Vendrell, D Yadav, R Raj, AR West Journal of the European Ceramic Society 39 (4), 1352-1358	15	2019
On the onset of fracture as a silicon-based polymer converts into the ceramic phase R Raj, L Pederiva, M Narisawa, GD Soraru Journal of the American Ceramic Society 102 (3), 924-929	8	2019
Flash sintering with current rate: A different approach P Kumar MK, D Yadav, JM Lebrun, R Raj Journal of the American Ceramic Society 102 (2), 823-835	29	2019
α-Alumina and spinel react into single-phase high-alumina spinel in< 3 seconds during flash sintering D Kok, D Yadav, E Sortino, SJ McCormack, KP Tseng, WM Kriven, R Raj, ... Journal of the American Ceramic Society 102 (2), 644-653	25	2019
Generation of Frenkel defects above the Debye temperature by proliferation of phonons near the Brillouin zone edge M Jongmanns, R Raj, DE Wolf New Journal of Physics 20 (9), 093013	28	2018
Measurement of O and Ti atom displacements in TiO_2 during flash sintering experiments B Yoon, D Yadav, R Raj, E Sortino, S Ghose, P Sarin, D Shoemaker Journal of the American Ceramic Society 101 (5), 1811-1817	43	2018
INTRODUCING NANOSCALE CERAMIC PARTICLES INTO METAL		2018

MATRICES R Raj ADVANCED MATERIALS & PROCESSES 176 (3), 25-29		
Phase-pure BiFeO 3 produced by reaction flash-sintering of Bi 2 O 3 and Fe 2 O 3 E Gil-González, A Perejón, PE Sánchez-Jiménez, MJ Sayagués, R Raj, ... Journal of Materials Chemistry A 6 (13), 5356-5366	53	2018
Two unique measurements related to flash experiments with yttria-stabilized zirconia D Yadav, R Raj Journal of the American Ceramic Society 100 (12), 5374-5378	32	2017
In-situ measurements of lattice expansion related to defect generation during flash sintering JM Lebrun, CS Hellberg, SK Jha, WM Kriven, A Steveson, KC Seymour, ... Journal of the American Ceramic Society 100 (11), 4965-4970	49	2017
Mechanism of electric field-induced softening (EFIS) of alkali silicate glasses C McLaren, B Roling, R Raj, H Jain Journal of Non-Crystalline Solids 471, 384-395	20	2017
Additive Manufacturing of Polymer Derived Ceramics R Raj US Patent App. 15/042,992	3	2017
Flash transition as a possible origin for low open circuit voltage in thin film solid oxide fuel cells R Raj, S Ramanathan Journal of Power Sources 359, 48-51	7	2017
Flash sintering of highly insulating nanostructured phase-pure $BiFeO_3$ LA Perez-Maqueda, E Gil-Gonzalez, A Perejon, JM Lebrun, ... Journal of the American Ceramic Society 100 (8), 3365-3369	44	2017
Flash sintering of a three-phase alumina, spinel, and yttria-stabilized zirconia composite D Kok, SK Jha, R Raj, ML Mecartney Journal of the American Ceramic Society 100 (7), 3262-3268	42	2017
The onset of the flash transition in single crystals of cubic zirconia as a function of electric field and temperature D Yadav, R Raj Scripta Materialia 134, 123-127	41	2017
Stress–rupture measurements of cast magnesium strengthened by in-situ production of ceramic particles NM Chelliah, L Kraemer, H Singh, MK Surappa, R Raj Journal of Magnesium and Alloys 5 (2), 225-230	10	2017
Current limit diagrams for dendrite formation in solid-state electrolytes for	93	2017

Li-ion batteries R Raj, J Wolfenstine Journal of Power Sources 343, 119-126		
Tunable hydrogen generation from sodium borohydride with silicon carbonitride functionalized carbon nanostructure electrode LH Hu, R Ceccato, R Raj international journal of hydrogen energy 42 (8), 5447-5454	1	2017
Processing, microstructural evolution and strength properties of in-situ magnesium matrix composites containing nano-sized polymer derived SiCNO particles NM Chelliah, H Singh, R Raj, MK Surappa Materials Science and Engineering: A 685, 429-438	25	2017
Direct growth of graphene-dielectric bi-layer structure on device substrates from Si-based polymer HK Seo, K Kim, SY Min, Y Lee, CE Park, R Raj, TW Lee 2D Materials 4 (2), 024001	10	2017
Electric field-assisted flash sintering of CaCu3Ti4O12: Microstructure characteristics and dielectric properties LM Jesus, RS Silva, R Raj, JC M'Peko Journal of Alloys and Compounds 682, 753-758	24	2016
Broadening of diffraction peak widths and temperature nonuniformity during flash experiments JM Lebrun, SK Jha, SJ McCormack, WM Kriven, R Raj Journal of the American Ceramic Society 99 (10), 3429-3434	27	2016
Analysis of the power density at the onset of flash sintering R Raj Journal of the American Ceramic Society 99 (10), 3226-3232	99	2016
Preliminary investigation of hydroxyapatite microstructures prepared by flash sintering I Bajpai, YH Han, J Yun, J Francis, S Kim, R Raj Advances in Applied Ceramics 115 (5), 276-281	25	2016
Additive manufacturing of SiCN ceramic matrix for SiC fiber composites by flash pyrolysis of nanoscale polymer films S Azarnoush, F Laubscher, L Zoli, R Raj Journal of the American Ceramic Society 99 (6), 1855-1858	5	2016
Correlations between conductivity, electroluminescence and flash sintering K Naik, SK Jha, R Raj Scripta Materialia 118, 1-4	34	2016
Microstructure and microchemistry of flash sintered K0. 5Na0. 5NbO3 G Corapcioglu, MA Gulgun, K Kisslinger, S Sturm, SK Jha, R Raj Journal of the Ceramic Society of Japan 124 (4), 321-328	29	2016
Beyond flash sintering in 3 mol% yttria stabilized zirconia	58	2016

SK Jha, K Terauds, JM Lebrun, R Raj
Journal of the Ceramic Society of Japan 124 (4), 283-288

Three-dimensional architecture of lithium-anodes made from graphite fibers coated with thin-films of silicon oxycarbide: Design, performance and manufacturability I Saleh, R Raj Journal of Power Sources 310, 18-25	6	2016
The Change of X-ray Diffraction Peak Width During *in situ* Conventional Sintering of Nanoscale Powders JM Lebrun, SK Jha, KS Naik, KC Seymour, WM Kriven, R Raj Journal of the American Ceramic Society 99 (3), 765-768	11	2016
Hafnia-silicon carbide nanocomposites II: Measurements of the residual stress Y Shinoda, R Raj, Y Minoguchi, T Akatsu, F Wakai Journal of the European Ceramic Society 36 (3), 937-942		2016
Phase transformation in the alumina–titania system during flash sintering experiments SK Jha, JM Lebrun, R Raj Journal of the European Ceramic Society 36 (3), 733-739	60	2016
Electric field-assisted ultrafast synthesis of nanopowders: a novel and cost-efficient approach LM Jesus, RS Silva, R Raj, JC M'Peko RSC advances 6 (109), 107208-107213	14	2016
Predicting structural properties of amorphous silicon carbonitride by atomistic simulation N Liao, M Zhang, R Raj, S Zhou International Journal of Materials and Structural Integrity 10 (1-3), 63-69	2	2016
Additive manufacturing of ceramics enabled by flash pyrolysis of polymer precursors with nanoscale layers L Zoli, D Sciti, LA Liew, K Terauds, S Azarnoush, R Raj Journal of the American Ceramic Society 99 (1), 57-63	18	2016
Electric field induced texture in titania during experiments related to flash sintering SK Jha, JM Lebrun, KC Seymour, WM Kriven, R Raj Journal of the European Ceramic Society 36 (1), 257-261	42	2016
A novel in-situ polymer derived nano ceramic MMC by friction stir processing A Kumar, R Raj, SV Kailas Materials & Design 85, 626-634	36	2015
Electric field-induced softening of alkali silicate glasses C McLaren, W Heffner, R Tessarollo, R Raj, H Jain Applied Physics Letters 107 (18), 184101	47	2015

Temperature distributions during flash sintering of 8% yttria-stabilized zirconia JG Pereira da Silva, JM Lebrun, HA Al-Qureshi, R Janssen, R Raj Journal of the American Ceramic Society 98 (11), 3525-3528	30	2015
Electroluminescence and the measurement of temperature during Stage III of flash sintering experiments K Terauds, JM Lebrun, HH Lee, TY Jeon, SH Lee, JH Je, R Raj Journal of the European Ceramic Society 35 (11), 3195-3199	92	2015
On the thermodynamically stable amorphous phase of polymer-derived silicon oxycarbide L Yu, R Raj Scientific reports 5 (1), 1-13	18	2015
Bubble nucleation during oxidation of SiC R Raj, K Terauds Journal of the American Ceramic Society 98 (8), 2579-2586	7	2015
Emergence and extinction of a new phase during on–off experiments related to flash sintering of 3 YSZ JM Lebrun, TG Morrissey, JSC Francis, KC Seymour, WM Kriven, R Raj Journal of the American Ceramic Society 98 (5), 1493-1497	77	2015
Semiconductive behavior of polymer-derived SiCN ceramics for hydrogen sensing LH Hu, R Raj Journal of the American Ceramic Society 98 (4), 1052-1055	18	2015
Si OCN functionalized carbon nanotube gas sensors for elevated temperature applications A Karakuscu, LH Hu, A Ponzoni, C Baratto, R Ceccato, G Sberveglieri, ... Journal of the American Ceramic Society 98 (4), 1142-1149	11	2015
Low-wear high-friction behavior of copper matrix composites dispersed with an in situ polymer derived ceramic E Castellan, SV Kailas, S Madayi, R Raj Journal of Tribology 137 (2)	4	2015
Evaluation of high temperature resistance of white Si–O–C (–H) ceramics in an inert atmosphere M Narisawa, K Terauds, G Ma, H Hokazono, R Raj, A Iwase Journal of Non-Crystalline Solids 410, 106-111	4	2015
Methods of flash sintering R Raj, M Cologna, ALG Prette, VM Sglavo, J Francis US Patent 8,940,220	44	2015
Flash sintering as a nucleation phenomenon and a model thereof KS Naik, VM Sglavo, R Raj Journal of the European Ceramic Society 34 (15), 4063-4067	137	2014
Field-assisted sintering of undoped BaTiO3: Microstructure evolution and	93	2014

dielectric permittivity JC M'Peko, JSC Francis, R Raj Journal of the European Ceramic Society 34 (15), 3655-3660		
Interfacially engineered liquid-phase-sintered Cu–In composite solders for thermal interface material applications J Liu, U Sahaym, I Dutta, R Raj, M Renavikar, RS Sidhu, R Mahajan Journal of Materials Science 49 (22), 7844-7854	14	2014
Reversible elastic deformation of functionalized sp^2 carbon at pressures of up to 33 GPa E Soignard, HD Hochheimer, J Yarger, R Raj Applied Physics Letters 105 (14), 141901		2014
Electric fields obviate constrained sintering SK Jha, R Raj Journal of the American Ceramic Society 97 (10), 3103-3109	25	2014
Field assisted sintering of ceramic constituted by alumina and yttria stabilized zirconia KS Naik, VM Sglavo, R Raj Journal of the European Ceramic Society 34 (10), 2435-2442	87	2014
Developing processing maps for implementing flash sintering into manufacture of whiteware ceramics F Trombin, R Raj Am. Ceram. Soc. Bull 93, 32-35	28	2014
A first report of photoemission in experiments related to flash sintering JM Lebrun, R Raj Journal of the American Ceramic Society 97 (8), 2427-2430	63	2014
Oxidation, mechanical and thermal properties of hafnia–silicon carbide nanocomposites Y Shinoda, DB Marshall, R Raj Journal of the European Ceramic Society 34 (7), 1783-1790	7	2014
Densification behaviour and microstructural development in undoped yttria prepared by flash-sintering H Yoshida, Y Sakka, T Yamamoto, JM Lebrun, R Raj Journal of the European Ceramic Society 34 (4), 991-1000	139	2014
Dramatic influence of interface chemical potentials on the oxidation of silicon and carbon based compounds K Terauds, R Raj Journal of the European Ceramic Society 34 (4), 1035-1039	1	2014
Ab inito and FTIR Studies of HfSiCNO Processed from the Polymer Route K Terauds, R Raj, P Kroll Journal of the American Ceramic Society 97 (3), 742-749	9	2014
Diffusive relaxation of Li in particles of silicon oxycarbide measured by galvanostatic titrations	16	2014

PD Weidman, D Ahn, R Raj
Journal of Power Sources 249, 219-230

The effect of electric field on sintering and electrical conductivity of titania SK Jha, R Raj Journal of the American Ceramic Society 97 (2), 527-534	144	2014
Polymer-Derived *In-Situ* Metal Matrix Composites Created by Direct Injection of a Liquid Polymer into Molten Magnesium K Terauds, AR Anilchandra, R Raj Metallurgical and Materials Transactions A 45 (2), 551-554	7	2014
Polymer-derived in-situ metal matrix composites created by direct injection of a liquid polymer into molten magnesium S Sudarshan, K Terauds, AR Anilchandra, R Raj METALLURGICAL AND MATERIALS TRANSACTIONS A-PHYSICAL METALLURGY AND MATERIALS …	12	2014
Can Die Configuration Influence Field-Assisted Sintering of Oxides in the SPS Process? R Raj, A Rehman Journal of the American Ceramic Society 96 (12), 3697-3700	5	2013
Impedance spectroscopy and dielectric properties of flash versus conventionally sintered yttria-doped zirconia electroceramics viewed at the microstructural level JC M'Peko, JSC Francis, R Raj Journal of the American Ceramic Society 96 (12), 3760-3767	77	2013
Oxidation process of white Si–O–C (–H) ceramics with various hydrogen contents M Narisawa, K Terauds, R Raj, Y Kawamoto, T Matsui, A Iwase Scripta Materialia 69 (8), 602-605	24	2013
A Novel *In Situ* Method for Producing a Dispersion of a Ceramic Phase into Copper That Remains Stable at $0.9T_M$ E Castellan, G Ischia, A Molinari, R Raj Metallurgical and Materials Transactions A 44 (10), 4734-4742	18	2013
Process for preparation of nano ceramic-metal matrix composites and apparatus thereof R Raj, MK Surappa US Patent 8,540,797	1	2013
Chemical Potential-Based Analysis for the Oxidation Kinetics of Si and SiC Single Crystals R Raj Journal of the American Ceramic Society 96 (9), 2926-2934	8	2013
A Langmuir-K inetic Model for CVD Growth from Chemical Precursors R Raj, SP Krumdieck Chemical Vapor Deposition 19 (7-8-9), 260-266	3	2013

Influence of the field and the current limit on flash sintering at isothermal furnace temperatures JSC Francis, R Raj Journal of the American Ceramic Society 96 (9), 2754-2758	174	2013
Pyrolysis of Titanicone Molecular Layer Deposition Films as Precursors for Conducting TiO_2/Carbon Composite Films AI Abdulagatov, KE Terauds, JJ Travis, AS Cavanagh, R Raj, SM George The Journal of Physical Chemistry C 117 (34), 17442-17450	49	2013
Limits to the Stability of the Amorphous Nature of Polymer-Derived HfSiCNO Compounds K Terauds, R Raj Journal of the American Ceramic Society 96 (7), 2117-2123	15	2013
Flash sintering of anode–electrolyte multilayers for SOFC applications JSC Francis, M Cologna, D Montinaro, R Raj Journal of the American Ceramic Society 96 (5), 1352-1354	45	2013
Oxidation of Polymer-Derived HfSi CNO up to 1600° C K Terauds, DB Marshall, R Raj Journal of the American Ceramic Society 96 (4), 1278-1284	23	2013
Grain boundary resistivity of yttria-stabilized zirconia at 1400 C J Wang, A Du, D Yang, R Raj, H Conrad Journal of Ceramics 2013	11	2013
Extreme-rate capable and highly stable SiCO–TiO 2 hybrids for Li ion battery anodes SK Behera, R Raj Chemical Communications 49 (83), 9657-9659	6	2013
The role of non-stoichiometric defects in radiation damage evolution of SrTiO 3 J Won, LJ Vernon, A Karakuscu, RM Dickerson, M Cologna, R Raj, ... Journal of Materials Chemistry A 1 (32), 9235-9245	11	2013
PDCs functionalized carbon nanostructure for gas sensing application LH Hu, R Raj, A Karakuscu, A Ponzoni, G Sberveglieri, R Ceccato SENSORS, 2012 IEEE, 1-3		2012
Particle size effects in flash sintering JSC Francis, M Cologna, R Raj Journal of the European Ceramic Society 32 (12), 3129-3136	115	2012
Defect structure of flash-sintered strontium titanate A Karakuscu, M Cologna, D Yarotski, J Won, JSC Francis, R Raj, ... Journal of the American Ceramic Society 95 (8), 2531-2536	142	2012
Joule heating during flash-sintering R Raj Journal of the European Ceramic Society 32 (10), 2293-2301	304	2012

Polymer-derived lubricant additive for ultra-low wear applications R Raj, SR Shah US Patent 8,232,234	13	2012
Flash-sinterforging of nanograin zirconia: field assisted sintering and superplasticity JSC Francis, R Raj Journal of the American Ceramic Society 95 (1), 138-146	99	2012
Surface energy of sol gel-derived silicon oxycarbide glasses A Tamayo, R Peña-Alonso, J Rubio, R Raj, GD Sorarù, JL Oteo Journal of the American Ceramic Society 94 (12), 4523-4533	23	2011
Field assisted and flash sintering of alumina and its relationship to conductivity and MgO-doping M Cologna, JSC Francis, R Raj Journal of the European Ceramic Society 31 (15), 2827-2837	289	2011
Liquid phase sintered Cu–In composite solders for thermal interface material and interconnect applications J Liu, P Kumar, I Dutta, R Raj, R Sidhu, M Renavikar, R Mahajan Journal of materials science 46 (21), 7012-7025	20	2011
Silicon-oxycarbide based thin film anodes for lithium ion batteries J Shen, R Raj Journal of Power Sources 196 (14), 5945-5950	51	2011
Influence of externally imposed and internally generated electrical fields on grain growth, diffusional creep, sintering and related phenomena in ceramics R Raj, M Cologna, JSC Francis Journal of the American Ceramic Society 94 (7), 1941-1965	282	2011
C-rate performance of silicon oxycarbide anodes for Li+ batteries enhanced by carbon nanotubes J Shen, D Ahn, R Raj Journal of Power Sources 196 (5), 2875-2878	23	2011
Cyclic stability and C-rate performance of amorphous silicon and carbon based anodes for electrochemical storage of lithium D Ahn, R Raj Journal of Power Sources 196 (4), 2179-2186	96	2011
Flash-sintering of Co2MnO4 spinel for solid oxide fuel cell applications ALG Prette, M Cologna, V Sglavo, R Raj Journal of Power Sources 196 (4), 2061-2065	187	2011
Surface diffusion-controlled neck growth kinetics in early stage sintering of zirconia, with and without applied DC electrical field M Cologna, R Raj Journal of the American Ceramic Society 94 (2), 391-395	59	2011
Flash-sintering of cubic yttria-stabilized zirconia at 750° C for possible use	226	2011

in SOFC manufacturing M Cologna, ALG Prette, R Raj Journal of the American Ceramic Society 94 (2), 316-319		
Superefficient thin film multilayer catalyst for generating hydrogen from sodium borohydride L Hu, R Ceccato, R Raj Journal of Power Sources 196 (2), 741-746	13	2011
Ultrahigh figure-of-merit for hydrogen generation from sodium borohydride using ternary metal catalysts L Hu, R Ceccato, R Raj Journal of Power Sources 196 (1), 69-75	28	2011
Flash Sintering of Nanograin Zirconia in< 5 s at 850 C M Cologna, B Rashkova, R Raj Journal of the American Ceramic Society 93 (11), 3556-3559	621	2010
Enhanced sintering rate of zirconia (3Y-TZP) through the effect of a weak dc electric field on grain growth D Yang, R Raj, H Conrad Journal of the American Ceramic Society 93 (10), 2935-2937	149	2010
Micro-Tubular solid oxide fuel cells with embedded current collector M Cologna, R De La Torre, VM Sglavo, R Raj Ceramic Engineering and Science Proceedings 31 (4), 15-21	2	2010
Transient viscous flow during the evolution of a ceramic (Silicon Carbonitride) from a polymer (Polysilazane) PE Sánchez-Jiménez, JA Downs, R Raj Journal of the American Ceramic Society 93 (9), 2567-2570	12	2010
Aerospace Materials for Extreme Environments J Fuller, G Hilmas, W Fahrenholtz, E Corral, L Riegel Journal of the European Ceramic Society 30 (11), 2145-2146	3	2010
Giant piezoresistivity of polymer-derived ceramics at high temperatures K Terauds, PE Sanchez-Jimenez, R Raj, C Vakifahmetoglu, P Colombo Journal of the European Ceramic Society 30 (11), 2203-2207	55	2010
Thermodynamic measurements pertaining to the hysteretic intercalation of lithium in polymer-derived silicon oxycarbide D Ahn, R Raj Journal of Power Sources 195 (12), 3900-3906	75	2010
Ultrahigh-temperature semiconductors made from polymer-derived ceramics HY Ryu, Q Wang, R Raj Journal of the American ceramic society 93 (6), 1668-1676	88	2010
Compression creep of alumina containing interfacial silicon, carbon, and nitrogen, derived from a polysilazane precursor E Castellan, SR Shah, R Raj	6	2010

Journal of the American Ceramic Society 93 (4), 954-958

Lithium insertion in polymer-derived silicon oxycarbide ceramics PE Sanchez-Jimenez, R Raj Journal of the American Ceramic Society 93 (4), 1127-1135	67	2010
Inverse problems in stochastic modeling of mixed-mode power-law and diffusional creep for distributed grain size J Bai, R Raj Metallurgical and Materials Transactions A 41 (2), 308	4	2010
Colossal anelasticity in polycrystals deforming under conditions of diffusional creep P Lee, R Raj Acta materialia 58 (2), 702-708		2010
Next generation materials for thermal interface and high density energy storage applications via liquid phase sintering J Liu, P Rottman, S Dutta, P Kumar, R Raj, M Renavikar, I Dutta 2009 11th Electronics Packaging Technology Conference, 506-511	9	2009
Liquid phase sintered solders with indium as minority phase for next generation thermal interface material applications I Dutta, R Raj, P Kumar, T Chen, CM Nagaraj, J Liu, M Renavikar, ... Journal of electronic materials 38 (12), 2735-2745	40	2009
Picoscale catalysts for hydrogen catalysis R Raj, G Carturan, R de la PENA-ALONSO US Patent App. 12/148,185	34	2009
A huge effect of weak dc electrical fields on grain growth in zirconia S Ghosh, AH Chokshi, P Lee, R Raj Journal of the American Ceramic Society 92 (8), 1856-1859	160	2009
Novel liquid phase sintered solders with indium as minority phase for next generation thermal interface material applications P Kumar, I Dutta, R Raj, M Renavikar, V Wakharkar 2008 Second International Conference on Thermal Issues in Emerging …	10	2008
Nanoceramic–metal matrix composites by in-situ pyrolysis of organic precursors in a liquid melt MK Surappa, D Ahn, R Raj Metallurgical and Materials Transactions A 39 (13), 3291-3297	11	2008
Nanoceramic-metal matrix composites by in-situ pyrolysis of organic precursors in a liquid melt M Sudarshan, MK Surappa, D Ahn, R Raj Metallurgical and Materials Transactions A 39 (13), 3291-3297	26	2008
Porous Al_2O_3-Spinel Based Polycrystals That Resist Free-Sintering SR Shah, AH Chokshi, R Raj Journal of the American Ceramic Society 91 (10), 3451-3454	7	2008

Energetics of $Si_xO_yC_z$ Polymer-Derived Ceramics Prepared Under Varying Conditions RM Morcos, A Navrotsky, T Varga, Y Blum, D Ahn, F Poli, K Müller, R Raj Journal of the American Ceramic Society 91 (9), 2969-2974	52	2008
A low-cost method for producing high-performance nanocomposite thin-films made from silica and CNTs on cellulose substrates E Callone, JM Fletcher, G Carturan, R Raj Journal of materials science 43 (14), 4862-4869	12	2008
Thermodynamically Stable $Si_wC_xN_yO_z$ Polymer-Like, Amorphous Ceramics Made from Organic Precursors RM Morcos, A Navrotsky, T Varga, D Ahn, A Saha, F Poli, K Müller, R Raj Journal of the American Ceramic Society 91 (7), 2391-2393	29	2008
Intensely photoluminescent pseudo-amorphous SiliconOxyCarboNitride polymer–ceramic hybrids L Ferraioli, D Ahn, A Saha, L Pavesi, R Raj Journal of the American Ceramic Society 91 (7), 2422-2424	30	2008
Novel liquid phase sintered sn-in solders with tailorable properties for thermal interface material and interconnect applications I Dutta, R Raj, D Suh, V Wakharkar 2007 9th Electronics Packaging Technology Conference, 365-369	4	2007
Study of the pyrolysis process of an hybrid CH3SiO1. 5 gel into a SiCO glass G Das, P Bettotti, L Ferraioli, R Raj, G Mariotto, L Pavesi, GD Soraru Vibrational Spectroscopy 45 (1), 61-68	61	2007
Novel composites constituted from hafnia and a polymer-derived ceramic as an interface: phase for severe ultrahigh temperature applications S Brahmandam, R Raj Journal of the American Ceramic Society 90 (10), 3171-3176	28	2007
Thermodynamically Stable $Si_xO_yC_z$ Polymer-Like Amorphous Ceramics T Varga, A Navrotsky, JL Moats, RM Morcos, F Poli, K Müller, A Saha, ... Journal of the American Ceramic Society 90 (10), 3213-3219	120	2007
Shear strength and sliding at a metal–ceramic (aluminum–spinel) interface at ambient and elevated temperatures G Singh, Y Yu, F Ernst, R Raj Acta materialia 55 (9), 3049-3057	22	2007
A phenomenological model (and experiments) for liquid phase sintering R Raj, G Rixecker, M Valentinotti Metallurgical and Materials Transactions A 38 (3), 628-637	7	2007
A picoscale catalyst for hydrogen generation from NaBH4 for fuel cells R Pena-Alonso, A Sicurelli, E Callone, G Carturan, R Raj Journal of Power Sources 165 (1), 315-323	155	2007
Multilayer Design and Evaluation of a High Temperature Environmental	23	2007

Barrier Coating for Si-Based Ceramics SR Shah, R Raj Journal of the American Ceramic Society 90 (2), 516-522		
Crystallization maps for SiCO amorphous ceramics A Saha, R Raj Journal of the American Ceramic Society 90 (2), 578-583	138	2007
Mechanical design for accommodating thermal expansion mismatch in multilayer coatings for environmental protection at ultrahigh temperatures J Bai, K Maute, SR Shah, R Raj Journal of the American Ceramic Society 90 (1), 170-176	6	2007
Selection of TiN as the Interconnect Material for Measuring the Electrical Conductivity of Polymer-Derived SiCN at High Temperatures HY Ryu, R Raj Journal of the American Ceramic Society 90 (1), 295-297	10	2007
Diffusion reactions at Al–MgAl 2 O 4 interfaces—and the effect of applied electric fields Y Yu, J Mark, F Ernst, T Wagner, R Raj Journal of materials science 41 (23), 7785-7797	14	2006
Mechanical and Tribological Behavior of Polymer-Derived Ceramics Constituted from $SiC_xO_yN_z$ T Cross, R Raj, SV Prasad, TE Buchheit, DR Tallant Journal of the American Ceramic Society 89 (12), 3706-3714	41	2006
Preparation of ultrathin-walled carbon-based nanoporous structures by etching pseudo-amorphous silicon oxycarbide ceramics R Peña-Alonso, GD Sorarù, R Raj Journal of the American Ceramic Society 89 (8), 2473-2480	81	2006
A model for the nanodomains in polymer-derived SiCO A Saha, R Raj, DL Williamson Journal of the American Ceramic Society 89 (7), 2188-2195	295	2006
Effect of steam velocity on the hydrothermal oxidation/volatilization of silicon nitride B Sudhir, R Raj Journal of the American Ceramic Society 89 (4), 1380-1387	20	2006
Synthesis and tribological behavior of silicon oxycarbonitride thin films derived from poly (urea) methyl vinyl silazane TJ Cross, R Raj, TJ Cross, SV Prasad, DR Tallant International journal of applied ceramic technology 3 (2), 113-126	37	2006
Nanocomposite ceramics of oxide and no-oxide phases and methods for producing same R Raj, A Saha, S Shah US Patent App. 10/511,464	8	2005
Influence of grain size variability on the strain rate dependence of the stress	10	2005

exponent in mixed-mode power law and diffusional creep J Bai, R Raj Metallurgical and Materials Transactions A 36 (11), 2913-2919		
The role of carbon in unexpected visco (an) elastic behavior of amorphous silicon oxycarbide above 1273 K A Scarmi, GD Sorarù, R Raj Journal of non-crystalline solids 351 (27-29), 2238-2243	82	2005
Passive oxidation of an effluent system: the case of polymer-derived SiCO S Modena, GD Sorarù, Y Blum, R Raj Journal of the American Ceramic Society 88 (2), 339-345	74	2005
Mechanical Behavior-Influence of Grain Size Variability on the Strain Rate Dependence of the Stress Exponent in Mixed-Mode Power Law and Diffusional Creep J Bai, R Raj Metallurgical and Materials Transactions-Series A 36 (11), 2913-2920		2005
Nanodevices that explore the synergies between PDCs and carbon nanotubes SR Shah, R Raj Journal of the European Ceramic Society 25 (2-3), 243-249	34	2005
Characterization of nanodomains in polymer-derived SiCN ceramics employing multiple techniques A Saha, R Raj, DL Williamson, HJ Kleebe Journal of the American Ceramic Society 88 (1), 232-234	84	2005
A methodology for analyzing the variability in the performance of a MEMS actuator made from a novel ceramic JS Kong, DM Frangopol, M Raulli, K Maute, RA Saravanan, LA Liew, ... Sensors and Actuators A: Physical 116 (2), 336-344	24	2004
Oxidation Behavior of SiCN–ZrO_2 Fiber Prepared from Alkoxide-Modified Silazane A Saha, SR Shah, R Raj Journal of the American Ceramic Society 87 (8), 1556-1558	43	2004
Magnetic and electrical transport properties of $\mathrm{La_{0.67}Ca_{0.33}MnO_3}$ (LCMO): $x\mathrm{SiCN}$ composites D Das, A Saha, CM Srivastava, R Raj, SE Russek, D Bahadur Journal of applied physics 95 (11), 7106-7108	5	2004
Temperature-dependent variability in lifetime prediction of thermally activated systems R Raj, IE Raj, DM Frangopol, JS Kong Metallurgical and Materials Transactions A 35 (5), 1471-1476	4	2004
Thiol-ene photopolymerization of polymer-derived ceramic precursors NB Cramer, SK Reddy, H Lu, T Cross, R Raj, CN Bowman Journal of Polymer Science Part A: Polymer Chemistry 42 (7), 1752-1757	57	2004

Rate mechanisms of a novel thiol-ene photopolymerization reaction SK Reddy, NB Cramer, AK O'Brien, T Cross, R Raj, CN Bowman Macromolecular Symposia 206 (1), 361-374	59	2004
Polymer-derived ceramic materials from thiol-ene photopolymerizations SK Reddy, NB Cramer, T Cross, R Raj, CN Bowman Chemistry of materials 15 (22), 4257-4261	68	2003
Investigation on the oxidation process of SiCO glasses by the means of non-Rutherford backscattering spectrometry A Vomiero, S Modena, GD Soraru, R Raj, Y Blum, G Della Mea Nuclear Instruments and Methods in Physics Research Section B: Beam …	14	2003
Polymer-derived SiCN composites with magnetic properties A Saha, SR Shah, R Raj, SE Russek Journal of materials research 18 (11), 2549-2551	44	2003
Amorphous silicon carbonitride fibers drawn from alkoxide modified ceraset™ A Saha, SR Shah, R Raj Journal of the American Ceramic Society 86 (8), 1443-1445	33	2003
Manufacturing and applications of polymer and ceramic MEMS from a novel material process for harsh environments LA Liew, R Raj Smart Structures and Materials 2003: Smart Electronics, MEMS, BioMEMS, and …	5	2003
Integration of Ceramics Research with the Development of a Microsystem RA Saravanan, LA Liew, VM Bright, R Raj Journal of the American Ceramic Society 86 (7), 1217-1219	11	2003
A real time human–machine interface for an ultrahigh temperature MEMS sensor–igniter JS Kong, K Maute, DM Frangopol, LA Liew, RA Saravanan, R Raj Sensors and Actuators A: Physical 105 (1), 23-30	15	2003
A novel micro glow plug fabricated from polymer-derived ceramics: in situ measurement of high-temperature properties and application to ultrahigh-temperature ignition LA Liew, VM Bright, R Raj Sensors and Actuators A: Physical 104 (3), 246-262	45	2003
Large magnetoresistance in $(\mathrm{La_{1-x}Ca}_x\mathrm{MnO_3})_{1-\mathrm{y}}:\mathrm{ZrO_2}$ composite D Das, A Saha, SE Russek, R Raj, D Bahadur Journal of applied physics 93 (10), 8301-8303	60	2003
YSZ layers by pulsed-MOCVD on solid oxide fuel cell electrodes SP Krumdieck, O Sbaizero, A Bullert, R Raj Surface and Coatings Technology 167 (2-3), 226-233	36	2003
Influence of distributed particle size on the determination of the parabolic rate constant for oxidation by the powder method SR Shah, A Saha, R Raj	8	2003

Journal of the American Ceramic Society 86 (2), 351-353

Processing and characterization of silicon carbon-nitride ceramics: application of electrical properties towards MEMS thermal actuators LA Liew, RA Saravanan, VM Bright, ML Dunn, JW Daily, R Raj Sensors and Actuators A: Physical 103 (1-2), 171-181	85	2003
Polymer-derived ceramic MEMS: Science and technology LA Liew, R Raj SPIE proceedings series, 246-251	1	2003
Solid Yttria-Stabilized Zirconia Films by Pulsed Chemical Vapor Deposition from Metal-organic Precursors SP Krumdieck, O Sbaizero, A Bullert, R Raj Journal of the American Ceramic Society 85 (11), 2873-2875	15	2002
Carbon Nanotubes Welded by Precursor-Derived Silicoboron Carbonitride Ceramics: A TEM Study Y Cai, SR Shah, A Zimmermann, M Weinmann, R Raj, F Aldinger physica status solidi (a) 193 (3), R13-R15	13	2002
Crystallization of polymer-derived silicon carbonitride at 1873 K under nitrogen overpressure M Friess, J Bill, J Golczewski, A Zimmermann, F Aldinger, R Riedel, R Raj Journal of the American Ceramic Society 85 (10), 2587-2589	45	2002
Mechanical properties of a fully dense polymer derived ceramic made by a novel pressure casting process SR Shah, R Raj Acta Materialia 50 (16), 4093-4103	147	2002
Pyrolysis kinetics for the conversion of a polymer into an amorphous silicon oxycarbide ceramic GD Sorarù, L Pederiva, J Latournerie, R Raj Journal of the American Ceramic Society 85 (9), 2181-2187	91	2002
Ion exchange at a metal–ceramic interface R Raj, A Saha, L An, DPH Hasselman, P Ernst Acta materialia 50 (5), 1165-1176	17	2002
Development of SiCN ceramic thermal actuators LA Liew, VM Bright, ML Dunn, JW Daily, R Raj Technical Digest. MEMS 2002 IEEE International Conference. Fifteenth IEEE …	13	2002
Fabrication process for ultra high aspect ratio polysilazane-derived MEMS T Cros, LA Liew, VM Bright, ML Dunn, JW Daily, R Raj Technical Digest. MEMS 2002 IEEE International Conference. Fifteenth IEEE …	12	2002
Pyrolysis Kinetics for the Conversion of a Polymer into an Amorphous Silicon Oxycarbide Ceramic. L Pederiva, J Latournerie Journal of the American Ceramic Society 85 (9), 2181-2187	11	2002

Silicon carbon-nitride ceramics: a high temperature semiconductor material for MEMS applications RA Saravanan, LA LIEW, VM BRIGHT, R RAJ SPIE proceedings series, 538-542	1	2002
TiN coating: A solution for high temperature interconnects HEEY RYU, RA Saravanan, R RAJ SPIE proceedings series, 490-493	1	2002
Application of microforging to SiCN MEMS fabrication Y Liu, LA Liew, R Luo, L An, ML Dunn, VM Bright, JW Daily, R Raj Sensors and Actuators A: Physical 95 (2-3), 143-151	96	2002
Fabrication of SiCN MEMS by photopolymerization of pre-ceramic polymer LA Liew, Y Liu, R Luo, T Cross, L An, VM Bright, ML Dunn, JW Daily, ... Sensors and Actuators A: Physical 95 (2-3), 120-134	213	2002
Nanoscale Densification Creep in Polymer-Derived Silicon Carbonitrides at 1350° C SR Shah, R Raj Journal of the American Ceramic Society 84 (10), 2208-2212	23	2001
Introduction to the special topical issue on ultrahigh-temperature polymer-derived ceramics R Raj, R Riedel, GD Soraru Journal of the American Ceramic Society 84 (10), 2158-2159	93	2001
Unique precursor delivery and control afforded by low-pressure pulsed-CVD process with ultrasonic atomization S Krumdieck, O Sbaizero, R Raj Le Journal de Physique IV 11 (PR3), Pr3-1161-Pr3-1168	17	2001
Oxidation kinetics of an amorphous silicon carbonitride ceramic R Raj, L An, S Shah, R Riedel, C Fasel, HJ Kleebe Journal of the American Ceramic Society 84 (8), 1803-1810	137	2001
Growth rate and morphology for ceramic films by pulsed-MOCVD S Krumdieck, R Raj Surface and Coatings Technology 141 (1), 7-14	44	2001
Fabrication of SiCN ceramic MEMS using injectable polymer-precursor technique LA Liew, W Zhang, VM Bright, L An, ML Dunn, R Raj Sensors and Actuators A: Physical 89 (1-2), 64-70	205	2001
Experimental characterization and modeling of pulsed MOCVD with ultrasonic atomization of liquid precursor SP Krumdieck, R Raj Chemical Vapor Deposition 7 (2), 85-90	38	2001
Fabrication of multi-layered SiCN ceramic MEMS using photo-polymerization of precursor LA Liew, R Luo, Y Liu, W Zhang, L An, VM Bright, ML Dunn, JW Daily, ...	11	2001

Technical Digest. MEMS 2001. 14th IEEE International Conference on Micro …

Fabrication of SiCN MEMS structures using microforged molds Y Liu, R Luo, L An, VM Bright, ML Dunn, JW Daily, R Raj Technical Digest. MEMS 2001. 14th IEEE International Conference on Micro …	14	2001
An interdisciplinary framework for the design and life prediction of engineering systems R Raj J. Eng. Mater. Technol. 122 (3), 348-354	15	2000
System-level optimization and design of the high speed machining process using ceramic cutting tools O Sbaizero, R Raj Materials & Design 21 (3), 175-189	6	2000
Crack formation in sapphire/niobium/sapphire joints under compression G Soyez, G Elssner, M Rühle, R Raj Journal of materials science 35 (5), 1087-1096	13	2000
Development of injectable polymer-derived ceramics for high temperature MEMS L An, W Zhang, VM Bright, ML Dunn, R Raj Proceedings IEEE Thirteenth Annual International Conference on Micro Electro …	10	2000
Ceramic MEMS L Liew, W Zhang, L An, S Shah, R Luo, Y Liu, T Cross, ML Dunn, V Bright, ... American Ceramic Society Bulletin 80 (5), 25	206	2000
A system level partitioning approach for analyzing the origins of variability in life prediction of tungsten filaments for incandescent lamps R Raj, MP Enright, DM Frangopol Materials & Design 21 (1), 9-18	16	1999
Measurement of an electrical potential induced by normal stress applied to the interface of an ionic material at elevated temperatures AK Pannikkat, R Raj Acta materialia 47 (12), 3423-3431	32	1999
Conversion Efficiency of Alkoxide Precursor to Oxide Films Grown by an Ultrasonic-Assisted, Pulsed Liquid Injection, Metalorganic Chemical Vapor Deposition (Pulsed-CVD) Process S Krumdieck, R Raj Journal of the American Ceramic Society 82 (6), 1605-1607	48	1999
Fracture toughness of diamondlike carbon coatings M Nastasi, P Kodali, KC Walter, JD Embury, R Raj, Y Nakamura Journal of materials research 14 (5), 2173-2180	43	1999
A methodology for integrating materials science with system engineering G Subbarayan, R Raj Materials & design 20 (1), 1-12	23	1999

Nanomechanical modeling of misfit dislocations at heterointerfaces F Ernst, R Raj, M Rühle Zeitschrift für Metallkunde 90 (12), 961-977	19	1999
Amorphous silicoboron carbonitride ceramic with very high viscosity at temperatures above 1500 C R Riedel, LM Ruswisch, L An, R Raj Journal of the American Ceramic Society 81 (12), 3341-3344	204	1998
Time evolution of stress redistribution around multiple fiber breaks in a composite with viscous and viscoelastic matrices IJ Beyerlein, SL Phoenix, R Raj International journal of solids and structures 35 (24), 3177-3211	75	1998
Constrained yielding in niobium single crystals bonded to sapphire G Soyez, G Elssner, M Rühle, R Raj Acta materialia 46 (10), 3571-3581	30	1998
Newtonian viscosity of amorphous silicon carbonitride at high temperature L An, R Riedel, C Konetschny, HJ Kleebe, R Raj Journal of the American Ceramic Society 81 (5), 1349-1352	220	1998
Crystallization of a Liquid (or a Glass) Contained within a Nanotube R Raj physica status solidi (a) 166 (1), 529-540	3	1998
Growth and structure of internal Cu/Al2O3 and Cu/Ti/Al2O3 interfaces G Dehm, C Scheu, M Rühle, R Raj Acta materialia 46 (3), 759-772	89	1998
Thermodynamic analysis of grain aspect ratio in fibrous microstructures of silicon nitride R Raj, MJ Hoffmann Journal of the American Ceramic Society 80 (12), 3250-3252	8	1997
Thermal diffusivity of particulate composites made from aluminum oxide and nickel aluminide by a photothermal deflection technique YD Chung, AP Chojnacka, CT Avedisian, R Raj Acta materialia 45 (7), 2983-2993	13	1997
Influence of microstructural scale on plastic flow behavior of metal matrix composites TW Gustafson, PC Panda, G Song, R Raj Acta Materialia 45 (4), 1633-1643	100	1997
Design and performance of a new type of Knudsen cell for chemical beam epitaxy using metal-organic precursors R Bellman, R Raj Vacuum 48 (2), 165-173	10	1997
A microindentation method for estimating interfacial shear strength and its use in studying the influence of titanium transition layers on the interface strength of epitaxial …	31	1997

G Dehm, M Rühle, HD Conway, R Raj
Acta materialia 45 (2), 489-499

Electric field induced domain rearrangement in potassium niobate thin films studied by *in situ* second harmonic generation measurements V Gopalan, R Raj Journal of applied physics 81 (2), 865-875	33	1997
Domain Wall Pinning by Grain Boundaries During Electric Field Poling of KNbO3 Thin Films V Gopalan, R Raj MRS Online Proceedings Library (OPL) 493	2	1997
Domain Structure-Second Harmonic Generation Correlation in Potassium Niobate Thin Films Deposited on a Strontium Titanate Substrate V Gopalan, R Raj Journal of the American Ceramic Society 79 (12), 3289-3296	21	1996
A tungsten filament high temperature heater for thin film deposition R Bellman, R Raj Review of scientific instruments 67 (11), 3958-3960	4	1996
A mechanistic basis for high strain rate superplasticity of aluminum based metal matrix composites R Raj Materials Science and Engineering: A 212 (1), 14-21	9	1996
Heteroepitaxial growth kinetics in a CVD process using nickel oxide on MgO as a model system B Hoghooghi, R Raj Journal of the American Ceramic Society 79 (4), 1019-1024	2	1996
Controlled epitaxial nucleation of nickel oxide on microfabricated magnesium oxide substrates in a CVD process B Hoghooghi, R Raj Journal of the American Ceramic Society 79 (4), 1025-1033	2	1996
Transmission electron microscopy study of microstructure and misfit dislocations in epitaxial $LiTaO_3$ thin films grown on sapphire by a metalorganic chemical vapor … H Xie, YC Lu, R Raj Journal of applied physics 79 (7), 3675-3680	4	1996
Domain structure and phase transitions in epitaxial $KNbO_3$ thin films studied by *in situ* second harmonic generation measurements V Gopalan, R Raj Applied physics letters 68 (10), 1323-1325	75	1996
The influence of micro structural scale on the creep resistance of high volume fraction ceramic-metal composites made from aluminum oxide and niobium Y Wang, R Raj Materials Science and Engineering: A 206 (1), 128-137		1996

Growth, Structure and Interfaces of Cu and Cu/Ti Thin Films on (0001) α-Al2O3 G Dehm, C Scheu, R Raj, M Rühle Materials Science Forum 207, 217-220	2	1996
Space-Charge-Controlled Diffusional Creep: Volume Diffusion Case J Jamnik, R Raj Journal of the American Ceramic Society 79 (1), 193-198	27	1996
Influence of grain size on ferroelastic toughening and piezoelectric behavior of lead zirconate titanate Z Zhang, R Raj Journal of the American Ceramic Society 78 (12), 3363-3368	67	1995
Metalorganic chemical vapor deposition by pulsed liquid injection using an ultrasonic nozzle: titanium dioxide on sapphire from titanium (IV) isopropoxide VA Versteeg, CT Avedisian, R Raj Journal of the American Ceramic Society 78 (10), 2763-2768	44	1995
Method and apparatus for CVD using liquid delivery system with an ultrasonic nozzle VA Versteeg, CT Avedisian, R Raj US Patent 5,451,260	280	1995
X-ray characterization of the domain structure of epitaxial lead titanate thin films on (001) strontium titanate WY Hsu, R Raj Applied physics letters 67 (6), 792-794	72	1995
Structure-Optical Property Correlation of Epitaxial Potassium Niobate Thin Films Deposited on Magnesium Oxide (100) Substrates Using a Strontium Titanate Transition Layer V Gopalan, R Raj Journal of the American Ceramic Society 78 (7), 1825-1833	32	1995
Electron Cyclotron Resonance Plasma-Enhanced Metalorganic Chemical Vapor Deposition of Tantalum Oxide Thin Films on Silicon near Room Temperature A Nagahori, R Raj Journal of the American Ceramic Society 78 (6), 1585-1592	20	1995
Growth and structure of copper thin films deposited on (0001) sapphire by molecular beam epitaxy G Dehm, M Rühle, G Ding, R Raj Philosophical magazine B 71 (6), 1111-1124	127	1995
The influence of Pt and SrTiO 3 interlayers on the microstructure of PbTiO 3 thin films deposited by laser ablation on (001) MgO S Stemmer, SK Streiffer, WY Hsu, F Ernst, R Raj, M Rühle Journal of materials research 10 (4), 791-794	28	1995

Nonlinear optical properties of epitaxial lithium tantalate thin films H Xie, WY Hsu, R Raj Journal of applied physics 77 (7), 3420-3425	44	1995
Measurement of oxygen activity modulated space charge potential at metal-ceramic interfaces using a CHEMFET with epitaxial LaF3 electrolyte WB Mattingly, R Raj Solid state ionics 75, 117-121	2	1995
Domain configurations in ferroelectric PbTiO3 thin films: the influence of substrate and film thickness S Stemmer, SK Streiffer, F Ernst, M Rühle, WY Hsu, R Raj Solid state ionics 75, 43-48	42	1995
Novel application of optically pumped vertical cavity surface emitting lasers: fast amplifying optical switch R Raj Journal de Physique III 4 (12), 2371-2378	2	1994
Analysis of the single-fiber-composite test to measure the mechanical properties of metal-ceramic interfaces JL Houpert, SL Phoenix, R Raj Acta metallurgica et materialia 42 (12), 4177-4187	35	1994
Design of the microstructural scale for optimum toughening in metallic composites R Raj, LR Thompson Acta metallurgica et materialia 42 (12), 4135-4142	30	1994
Nanostructure and chemistry of a (100) MgO/(100) GaAs interface J Bruley, S Stemmer, F Ernst, M Rühle, WY Hsu, R Raj Applied physics letters 65 (5), 564-566	17	1994
In situ study of MgO on GaAs (001) for integrating thin film ferroelectrics with semiconductors J Anderson, J Conner, R Raj Ferroelectrics 157 (1), 353-358	2	1994
In situ stress-strain response of small metal particles embedded in a ceramic matrix LR Thompson, R Raj Acta metallurgica et materialia 42 (7), 2477-2485	25	1994
TEM study of the structure and chemistry of a diamond/silicon interface Y Tzou, J Bruley, F Ernst, M Rühle, R Raj Journal of materials research 9 (6), 1566-1572	29	1994
Growth of epitaxial lithium tantalate on sapphire by chemical beam epitaxy from lithium hexaethoxy-tantalate R Bellman, R Raj Ferroelectrics 152 (1), 7-12	5	1994
Orientation control of KNbO3 thin films deposited by laser ablation on MgO	6	1994

(100) using SrTiO3 transition layers V Gopalan, H Xie, WY Hsu, R Raj Ferroelectrics 152 (1), 55-60		
Crystallization of the nanophase in silicon nitrides R Raj Tailoring of Mechanical Properties of Si3N4 Ceramics, 201-216	6	1994
Electronic structure and bonding at interfaces between cvd diamond and silicon DA Muller, Y Tzou, R Raj, J Silcox MRS Online Proceedings Library (OPL) 332	2	1994
Determination of fracture toughness and bridging tractions from crack-opening displacement measurements in particulate composites of diamond in zinc sulfide DS Farquhar, SL Phoenix, R Raj Acta metallurgica et materialia 42 (1), 65-75	8	1994
Epitaxial $LiTaO_3$ thin film by pulsed metalorganic chemical vapor deposition from a single precursor H Xie, R Raj Applied physics letters 63 (23), 3146-3148	58	1993
Mapping sp 2 and sp 3 states of carbon at sub-nanometre spatial resolution DA Muller, Y Tzou, R Raj, J Silcox Nature 366 (6457), 725-727	284	1993
$BaSi_2$ and thin film alkaline earth silicides on silicon RA McKee, FJ Walker, JR Conner, R Raj Applied physics letters 63 (20), 2818-2820	134	1993
Fundamental research in structural ceramics for service near 2000 C R Raj Journal of the American Ceramic Society 76 (9), 2147-2174	288	1993
Model for interface reaction control in superplastic deformation of non-stoichiometric ceramics R Raj Materials Science and Engineering: A 166 (1-2), 89-95	18	1993
Reply to “Comment on ‘Analysis of the Sintering Pressure’” R Raj Journal of the American Ceramic Society 76 (7), 1903-1903	4	1993
Temperature programmed desorption studies of the copper-sapphire (0001) system Y Ding, J Blakely, R Raj Materials Science and Engineering: A 162 (1-2), 131-134		1993
Diamond and diamond-like films and coatings prepared by deposition on substrate that contain a dispersion of diamond particles R Raj, AJ Sievers	38	1993

US Patent 5,206,083

Superplastic flow in a non-stoichiometric ceramic: Magnesium aluminate spinel R Lappalainen, A Pannikkat, R Raj Acta metallurgica et materialia 41 (4), 1229-1235	25	1993
Infra red diamond composites R Raj, AJ Sievers, L Yue, TW Noh US Patent 5,183,602	16	1993
High resolution EELS at grain boundaries DA Muller, Y Tzou, R Raj, J Silcox Nature 366, 725-727	4	1993
Blue Light by Second Harmonic Generation in Epitaxial $PbTiO_3$ Thin Film Waveguide WY Hsu, R Raj MRS Online Proceedings Library Archive 329		1993
First Order Quasi-Phase-Matched Second-Harmonic Generation in $LiTaO_3$ Utilizing a Periodic Domain Inversion Created by an External Stress TA Strasser, R Raj MRS Online Proceedings Library Archive 329		1993
The Design of the Interface Phase for Obtaining Thermal Shock Resistance in Silicon Nitride R Raj Thermal Shock and Thermal Fatigue Behavior of Advanced Ceramics, 207-221	3	1993
Deposition of Titanium Oxide Films from Metal-Organic Precursor by Electron Cyclotron Resonance Plasma-Assisted Chemical Vapor Deposition A Nagahori, R Raj MRS Online Proceedings Library (OPL) 335	2	1993
Non-beading, thin-film, metal-coated ceramic substrate R Raj US Patent 5,173,354	10	1992
Overview no. 100 Scalings in fracture probabilities for a brittle matrix fiber composite SL Phoenix, R Raj Acta metallurgica et materialia 40 (11), 2813-2828	142	1992
Rate effects in metal-ceramic interface sliding from the periodic film cracking technique VC Jobin, R Raj, SL Phoenix Acta metallurgica et materialia 40 (9), 2269-2280	36	1992
MgO epitaxial thin films on (100) GaAs as a substrate for the growth of oriented $PbTiO_3$ WY Hsu, R Raj Applied physics letters 60 (25), 3105-3107	114	1992

Influence of green state processing on the properties of diamond/zinc sulphide composites LA Xue, R Raj Journal of materials science 27 (11), 3021-3025	2	1992
Creep fracture experiments with planar sapphire□ copper interfaces stressed in tension CM Kennefick, R Raj Acta metallurgica et materialia 40 (4), 615-624	10	1992
Model for the crystallization and sintering of unseeded and seeded boehmite gels S Jagota, R Raj Journal of materials science 27 (8), 2251-2257	20	1992
Ultrahigh vacuum chemical vapor deposition of rhodium thin films on clean and TiO2-covered Si (111) JP Lu, PW Chu, R Raj, H Gysling Thin Solid Films 208 (2), 172-176	18	1992
A MODEL FOR SUBGRAIN SUPERPLASTICITY-REPLY R RAJ SCRIPTA METALLURGICA ET MATERIALIA 26 (1), 151-152		1992
The effect of particle size on the thermal conductivity of ZnS/diamond composites AG Every, Y Tzou, DPH Hasselman, R Raj Acta Metallurgica et Materialia 40 (1), 123-129	412	1992
Enhancing bonding at metal-ceramic interfaces SL Sass, R Raj, F Shieu US Patent 5,074,941	5	1991
Enhancing Bonding at Metal/Ceramic Interfaces SL Sass, R Raj, FS Shieu Patent NumberUS 5074941		1991
Optical properties of ZnS/diamond composites LA Xue, TW Noh, AJ Sievers, R Raj Diamond Optics IV 1534, 183-196	3	1991
Ultra-high vacuum metalorganic chemical vapor deposition of GaAs thin films onto Si (100) using a single-source precursor JP Lu, R Raj, A Wernberg Thin solid films 205 (2), 236-240	6	1991
Microtensile superplasticity in ceramic fibers R Lappalainen, R Raj Acta metallurgica et materialia 39 (12), 3125-3132	18	1991
Thin films of transition metals on oxides R Raj, A Pearce, CM Kennefick Acta metallurgica et materialia 39 (12), 3187-3191	26	1991

Interface effects in superplastic deformation of alumina containing zirconia, titania or hafnia as a second phase J Wang, R Raj Acta metallurgica et materialia 39 (11), 2909-2919	50	1991
Solution precursor chemical vapor deposition of titanium oxide thin films JP Lu, J Wang, R Raj Thin Solid Films 204 (1), L13-L17	104	1991
Ultra-high vacuum chemical vapor deposition and in situ characterization of titanium oxide thin films JP Lu, R Raj Journal of materials research 6 (9), 1913-1918	46	1991
Activation energy for the sintering of two-phase alumina/zirconia ceramics J Wang, R Raj Journal of the American Ceramic Society 74 (8), 1959-1963	193	1991
Grain growth in superplastically deformed zinc sulfide/diamond composites LA Xue, R Raj Journal of the American Ceramic Society 74 (7), 1729-1731	12	1991
Control of the Microstructure of Alumina–Zirconia Alloys Starting from Inorganic Salts J Wang, R Raj Journal of the American Ceramic Society 74 (7), 1707-1709	10	1991
A model for subgrain superplastic flow in aluminum alloys C Gandhi, R Raj Acta metallurgica et materialia 39 (4), 679-688	26	1991
Effect of hot-pressing temperature on the optical transmission of zinc sulfide LA Xue, R Raj Applied physics letters 58 (5), 441-443	32	1991
Control of the mechanical properties of metal-ceramic interfaces through interfacial reactions FS Shieu, R Raj, SL Sass Acta Metallurgica et Materialia 38 (11), 2215-2224	88	1990
Fracture and stiffness characteristics of particulate composites of diamond in zinc sulfide DS Farquhar, R Raj, SL Phoenix Journal of the American Ceramic Society 73 (10), 3074-3080	25	1990
Optical and mechanical properties of zinc sulphide diamond composites LA Xue, DS Farquhar, TW Noh, AJ Sievers, R Raj Acta Metallurgica et Materialia 38 (9), 1743-1752	17	1990
Effect of diamond dispersion on the superplastic rheology of zinc sulfide LA Xue, R Raj Journal of the American Ceramic Society 73 (8), 2213-2216	16	1990

Premelting at triple grain junctions R Raj Acta Metallurgica et Materialia 38 (8), 1413-1416	16	1990
In-Situ Measurement of Silica-Gel Coating on Particles of Alumina DC Agrawal, R Raj, C Cohen Journal of the American Ceramic Society 73 (7), 2163-2164	19	1990
Better Sintering through Green-State Deformation Processing CP Cameron, R Raj Journal of the American Ceramic Society 73 (7), 2032-2037	53	1990
Ultimate shear strengths of copper-silica and nickel-silica interfaces DC Agrawal, R Raj Materials Science and Engineering: A 126 (1-2), 125-131	79	1990
Estimate of the activation energies for boundary diffusion from rate-controlled sintering of pure alumina, and alumina doped with zirconia or titania J Wang, R Raj Journal of the American Ceramic Society 73 (5), 1172-1175	383	1990
The Influence of Grain Boundary Structure on Strain-Induced Grain Growth During Superplastic Deformation HJ Frost, R Raj MRS Online Proceedings Library Archive 196	2	1990
Deformation-induced phase transformation in zinc sulphide LA Xue, R Raj Kluwer Academic Publishers; Chapman and Hall Ltd; Springer Science+ Business …	18	1990
Superconducting rotating assembly FC Moon, R Raj US Patent 4,886,778	58	1989
Effect of the heating rate on the relative rates of sintering and crystallization in glass PC Panda, WM Mobley, R Raj Journal of the American Ceramic Society 72 (12), 2361-2364	55	1989
Investigation of the infrared properties of ZnS: diamond composites TW Noh, AJ Sievers, LA Xue, R Raj Optics letters 14 (22), 1260-1262	5	1989
Nucleation of flocs in dilute colloidal suspensions DC Agrawal, R Raj, C Cohen Journal of the American Ceramic Society 72 (11), 2148-2153	14	1989
Copper on sapphire: stability of thin films at 0.7 Tm CM Kennefick, R Raj Acta Metallurgica 37 (11), 2947-2952	91	1989
Composites comprising silicon carbide fibers dispersed in magnesia-	2	1989

aluminate matrix and fabrication thereof and of other composites by sinter forging PC Panda, ER Seydel, R Raj US Patent 4,871,496		
Superplastic deformation of zinc sulfide near its transformation temperature [1020] LA Xue, R Raj Journal of the American Ceramic Society 72 (10), 1792-1796	39	1989
Flaw generation during constrained sintering of metal-ceramic and metal–glass multilayer films T Cheng, R Raj Journal of the American Ceramic Society 72 (9), 1649-1655	139	1989
Sintering and crystallization of glass at constant heating rates PC Panda, R Raj Journal of the American Ceramic Society 72 (8), 1564-1566	44	1989
Superplastic forging of zirconia ceramics PC Panda, ER Seydel, R Raj US Patent 4,849,142	18	1989
Autonucleation of cavities in thin ceramic films DC Agrawal, R Raj Acta metallurgica 37 (7), 2035-2038	44	1989
Type 2 magnetic levitation on sinter-forged YBa sub 2 Cu sub 3 O sub x superconductor J Wang, MM Yanoviak, R Raj Journal of the American Ceramic Society;(United States) 72 (5)		1989
Type II Magnetic Levitation on Sinter-Forged $YBa_2Cu_3O_x$ Superconductor J Wang, MM Yanoviak, R Raj Journal of the American Ceramic Society 72 (5), 846-848	29	1989
Shear and densification of glass powder compacts VC Ducamp, R Raj Journal of the American Ceramic Society 72 (5), 798-804	71	1989
Measurement of the ultimate shear strength of a metal-ceramic interface DC Agrawal, R Raj Acta Metallurgica 37 (4), 1265-1270	402	1989
Fracture in monolithic ceramics at high temperatures R Raj ICF 7. Advances in Fracture Research. 4, 2769-2785	5	1989
Producing alpha-alumina whiskers S Jagota, R Raj US Patent 4,806,198	11	1989
Sinter-Forging Characteristics of Fine-Grained Zirconia	71	1988

PC Panda, J Wang, R Raj
Journal of the American Ceramic Society 71 (12), C-507-C-509

Grain-Growth Transition During Sintering of Colloidally Prepared Alumina Powder Compacts CP Cameron, R Raj Journal of the American Ceramic Society 71 (12), 1031-1035	145	1988
RELATIONSHIPS BETWEEN INTERFACE STRUCTURE AND SUPERPLASTIC DEFORMATION R Raj Le Journal de Physique Colloques 49 (C5), C5-35-C5-47	3	1988
Optical reflectivity studies of polycrystalline La 4 BaCu 5 O 13 and La 2 SrCu 2 O 6+ δ SG Kaplan, TW Noh, PE Sulewski, H Xia, AJ Sievers, J Wang, R Raj Physical Review B 38 (7), 5006	12	1988
Spatial variations in the sintering rate of ordered and disordered particle structures EG Liniger, R Raj Journal of the American Ceramic Society 71 (9), C-408-C-410	34	1988
Shear deformation and compaction of nickel aluminide powders at elevated temperatures PC Panda, J Lagraff, R Raj Acta Metallurgica 36 (8), 1929-1939	10	1988
A SYSTEM APPROACH TO DESIGN AND PROCESSING OF CERAMIC SUBSTRATES FOR ELECTRONIC PACKAGING R RAJ JOURNAL OF METALS 40 (7), A19-A19		1988
Measurement of the sintering pressure in ceramic films T CHENG, R RAJ Journal of the American Ceramic Society 71 (4), 276-280	27	1988
Sintering of TiO_2–Al_2O_3 Composites: A Model Experimental Investigation RK Bordia, R RAJ Journal of the American Ceramic Society 71 (4), 302-310	130	1988
Superplastic forging nitride ceramics PC Panda, ER Seydel, R Raj Jupiter Technologies	2	1988
Superplastic forging nitride ceramics PC Panda, ER Seydel, R Raj US Patent 4,732,719	7	1988
Hot isostatic pressing of ceramic/ceramic composites at pressures< 10 MPa RK Bordia, R Raj Advanced Ceramic Materials;(USA) 3 (2)	34	1988

Mechanisms of Superplastic Deformation in Ceramics R Raj Superplasticity and Superplastic Forming, 583-594	8	1988
Interface science and engineering'87 R Raj, SL Sass J. Phys. Paris 49, C5	20	1988
Sapphire whiskers from boehmite gel seeded with α-alumina S Jagota, R Raj Journal of crystal growth 85 (3), 527-534	24	1987
Packing and Sintering of Two-Dimensional Structures Made fro Bimodal Particle Size Distributions E LINIGER, R Raj Journal of the American Ceramic Society 70 (11), 843-849	89	1987
Internal friction in tholeiitic basalts AT Weiner, MH Manghnani, R Raj Journal of Geophysical Research: Solid Earth 92 (B11), 11635-11643	16	1987
Analysis of the sintering pressure R Raj Journal of the American Ceramic Society 70 (9), C-210-C-211	109	1987
SINTER FORGING OF NICKEL ALUMINIDE POWDER COMPACTS R RAJ, J LAGRAAF, PC PANDA JOURNAL OF METALS 39 (7), A18-A18		1987
Enhancement of strength through sinter forging KR Venkatachari, R Raj Journal of the American Ceramic Society 70 (7), 514-520	76	1987
Liquid-Phase Bonding of Silicon Nitride Ceramics S Baik, R Raj Journal of the American Ceramic Society 70 (5), C-105-C-107	34	1987
Unstable Spreading of a Fluid Inclusion in a Grrain Boundary under Normal Stress R RAJ Journal of the American Ceramic Society 69 (9), 708-712	18	1986
Shear deformation and densification of powder compacts KR Venkatachari, R Raj Journal of the American Ceramic Society 69 (6), 499-506	200	1986
Kinetics of precipitation of. cap alpha.-Al/sub 2/O/sub 3/in polycrystalline supersaturated MgOx2Al/sub 2/O/sub 3/spinel solid solution PC Panda, R Raj J. Am. Ceram. Soc.;(United States) 69 (5)		1986
Kinetics of Precipitation of α-Al_2O_3 in Polycrystalline Supersaturated MgO - $2Al_2O_3$ Spinel Solid Solution	28	1986

PC Panda, R Raj
Journal of the American Ceramic Society 69 (5), 365-373

Slip-twin interactions in bicrystals of nickel at 573K at large strains LC Lim, R Raj Scripta metallurgica 20 (4), 539-544	9	1986
A model for the evolution of grain size distribution during superplastic deformation AK Ghosh, R Raj Acta metallurgica 34 (3), 447-456	55	1986
Analysis of Sintering of a Composite with a Glass or Ceramic Matrix RK Bordia, R Raj Journal of the American Ceramic Society 69 (3), C-55-C-57	80	1986
Superplastic Flow in Fine-Grained Alumina KR Venkatachari, R Raj Journal of the American Ceramic Society 69 (2), 135-138	142	1986
Role of Shear in the Sintering of Composites RK Bordia, R Raj Tailoring Multiphase and Composite Ceramics, 27-39	9	1986
The role of residual dislocation arrays in slip induced cavitation, migration and dynamic recrystallization at grain boundaries LC Lim, R Raj Acta Metallurgica 33 (12), 2205-2214	45	1985
Use of free silicon in liquid phase sintering of silicon nitrides and sialons R Raj, S Baik US Patent 4,552,711	10	1985
Superplastic Deformation in Fine-Grained MgO $2Al_2O_3$ Spinel PC Panda, R Raj, PED Morgan Journal of the American Ceramic Society 68 (10), 522-529	73	1985
Continuity of slip screw and mixed crystal dislocations across bicrystals of nickel at 573 K LC Lim, R Raj Acta Metallurgica 33 (8), 1577-1583	110	1985
Suppression of frothing by silicon addition during oxynitride glass synthesis S BAIK, R RAJ Journal of the American Ceramic Society 68 (7), C-168-C-170	11	1985
Sintering behavior of ceramic films constrained by a rigid substrate RK Bordia, R Raj Journal of the American Ceramic Society 68 (6), 287-292	261	1985
Effect of Silicon Activity on Liquid-Phase Sintering of Nitrogen Ceramics S BAIK, R Raj Journal of the American Ceramic Society 68 (5), C-124-C-126	21	1985

Segregation of Mg to the (0001) surface of doped sapphire S Baik, DE Fowler, JM Blakely, R Raj Journal of the American Ceramic Society 68 (5), 281-286	94	1985
Interaction between lattice and grain boundary dislocations and their role in mechanical properties of interfaces LC Lim, R Raj Le Journal de Physique Colloques 46 (C4), C4-581-C4-595	42	1985
On the retention of equiaxed grain structure after superplastic and other forms of high temperature deformation R Raj, FF Lange Acta Metallurgica 33 (4), 699-703	6	1985
The Evolution of, Grain Size Distribution During Superplastic Deformation AK Ghosh, R Raj Superplasticity, pages 11, 19	4	1985
Flow and fracture at elevated temperatures R Raj American Society for Metals, Metals Park, OH	11	1985
Use of silicon in liquid sintered silicon nitrides and sialons R Raj, S Baik US Patent 4,487,840	6	1984
Superplastic deformation of an ultrafine grained intermetallic alloy prepared by crystallization of a metallic glass S Reusswig, R Gleichmann, PG Zielinski, DG Ast, R Raj Acta Metallurgica 32 (9), 1553-1560	10	1984
Effect of boundary structure on slip-induced cavitation in polycrystalline nickel LC Lim, R Raj Acta Metallurgica 32 (8), 1183-1190	111	1984
On the distribution of Σ for grain boundaries in polycrystalline nickel prepared by strainannealing technique LC Lim, R Raj Acta Metallurgica 32 (8), 1177-1181	129	1984
Sintering behavior of bi-modal powder compacts R Raj, RK Bordia Acta Metallurgica 32 (7), 1003-1019	282	1984
Influence of Hydrostatic Pressure and Humidity on Superplastic Ductility of Two β-Spodumene Glass-Ceramics JG Wang, R Raj Journal of the American Ceramic Society 67 (6), 385-390	66	1984
Mechanism of superplastic flow in a fine-grained ceramic containing some liquid phase JG Wang, R Raj	188	1984

Journal of the American Ceramic Society 67 (6), 399-409

On slip-induced intergranular cavitation during low-cycle fatigue of nickel at intermediate temperature LC Lim, R Raj Acta Metallurgica 32 (5), 727-733	36	1984
A STATISTICAL-ANALYSIS FOR ESTIMATING TOUGHNESS OF FIBROUS COMPOSITES R RAJ, SL PHOENIX AMERICAN CERAMIC SOCIETY BULLETIN 63 (12), 1474-1474		1984
Superplastic flow in ceramics enhanced by a liquid phase R Raj, RL Tsai, JG Wang, CK Chyung Deformation of Ceramic Materials II, 353-378	9	1984
Flow and fracture at elevated temperatures R Raj Philadelphia, 1985	11	1983
Mechanisms of Creep--Fatigue Interaction R Raj Flow and fracture at elevated temperatures, 215-249	15	1983
Environmental effects in nickel-base alloys S Floreen, R Raj Flow and fracture at elevated temperatures, 383-405	23	1983
Creep-fatigue interaction in OFHC-copper S Baik, R Raj Scripta metallurgica 17 (9), 1087-1090	4	1983
Control of superplastic cavitation by hydrostatic pressure CC Bampton, MW Mahoney, CH Hamilton, AK Ghosh, R Raj Metallurgical Transactions A 14 (8), 1583-1591	78	1983
Thermodynamics of Grain-Boundary Glass Crystallization R Raj Progress in Nitrogen Ceramics, 337-337		1983
Correlations between cavitation, creep and dilation for multiaxial loading R Raj Acta Metallurgica 31 (1), 29-36	10	1983
Creep fracture in ceramics containing small amounts of a liquid phase RL Tsai, R Raj Perspectives in Creep Fracture, 145-160	174	1983
Influence of hydrostatic pressure and multiaxial straining on cavitation in a superplastic aluminum alloy CC Bampton, R Raj Acta Metallurgica 30 (11), 2043-2053	93	1982
Wedge type creep damage in low cycle fatigue	39	1982

S Baik, R Raj
Metallurgical Transactions A 13 (7), 1207-1214

Mechanisms of creep-fatigue interaction S Baik, R Raj Metallurgical Transactions A 13 (7), 1215-1221	56	1982
Creep in polycrystalline aggregates by matter transport through a liquid phase R Raj Journal of Geophysical Research: Solid Earth 87 (B6), 4731-4739	416	1982
A Theoretical Estimate of Solution-Precipitation Creep in MgO-Fluxed Si_3N_4 RL Tsai, R Raj Journal of the American Ceramic Society 65 (6), c88-c90	13	1982
Intergranular creep fracture in aggressive environments R Raj Acta Metallurgica 30 (6), 1259-1268	42	1982
Dissolution Kinetics of β-Si_3N_4 in an Mg-Si-O-N Glass RL Tsai, R Raj Journal of the American Ceramic Society 65 (5), 270-274	25	1982
Separation of cavitation-strain and creep-strain during deformation R Raj Journal of the American Ceramic Society 65 (3), C-46-C-46	117	1982
The effect of environment on grain boundary internal friction in an Al□ 5% Mg alloy S Baik, R Raj Acta Metallurgica 30 (2), 499-503	9	1982
Intergranular fracture in bicrystals—II C Gandhi, R Raj Acta Metallurgica 30 (2), 505-511	21	1982
Limiting densities for dense random packing of spheres HJ Frost, R Raj Journal of the American Ceramic Society 65 (2), C-19-C-21	22	1982
Crystallization of small quantities of glass (or a liquid) segregated in grain boundaries R Raj, FF Lange Acta Metallurgica 29 (12), 1993-2000	133	1981
Micromechanisms of Creep Crack Growth in Nickel-Based Superalloys C Gandhi, R Raj Micro And Macro Mechanics Of Crack Growth, 131-136	3	1981
Activation Energies for Densification, Creep, and Grain-Boundary Sliding in Nitrogen Ceramics R Raj, PED Morgan	77	1981

Journal of the American Ceramic Society 64 (10), C-143-C-145

Stress rupture R Raj, AK Ghosh Metallurgical Transactions A 12 (7), 1291-1302	51	1981
Development of a processing map for use in warm-forming and hot-forming processes R Raj Metallurgical transactions A 12 (6), 1089-1097	410	1981
Morphology and stability of the glass phase in glass ceramic systems R Raj Journal of the American Ceramic Society 64 (5), 245-248	103	1981
Kinetics of Dissolution and Crystallization in a β-Spodumene Glass-Ceramic KH Dalal, R Raj Journal of the American Ceramic Society 64 (4), 194-200	16	1981
Grain size distribution effects in superplasticity AK Ghosh, R Raj Acta metallurgica 29 (4), 607-616	145	1981
An upper bound on strain rate for wedge type fracture in nickel during creep C Gandhi, R Raj Metallurgical Transactions A 12 (3), 515-520	49	1981
Micromechanical modelling of creep using distributed parameters R Raj, AK Ghosh Acta Metallurgica 29 (2), 283-292	77	1981
SUPERPLASTIC FLOW IN GLASS-CERAMICS JG WANG, R RAJ AMERICAN CERAMIC SOCIETY BULLETIN 60 (3), 381-381		1981
FRACTURE IN POLYCRYSTALLINE CERAMICS AT HIGH-TEMPERATURE R RAJ AMERICAN CERAMIC SOCIETY BULLETIN 60 (8), 850-850		1981
FRACTURE IN POLYCRYSTALLINE CERAMICS AT ELEVATED-TEMPERATURE R RAJ JOURNAL OF METALS 33 (9), A2-A2		1981
CRYSTALLIZATION OF SMALL QUANTITIES OF GLASS SEGREGATED IN GRAIN-BOUNDARIES R RAJ, FF LANGE AMERICAN CERAMIC SOCIETY BULLETIN 60 (3), 379-379		1981
HIGH-TEMPERATURE FRACTURE OF 2 PHASE ALLOYS R RAJ JOURNAL OF METALS 33 (9), A22-A22		1981

INTERACTION BETWEEN CREEP DAMAGE AND FATIGUE CRACK-PROPAGATION R RAJ JOURNAL OF METALS 33 (9), A64-A64		1981
CREEP DAMAGE IN LOW-CYCLE FATIGUE-II S BAIK, R RAJ JOURNAL OF METALS 33 (9), A12-A12		1981
EFFECT OF TIME, TEMPERATURE, AND OXYGEN ACTIVITY ON CRYSTALLIZATION OF OXYNITRIDE GLASSES RL TSAI, R RAJ AMERICAN CERAMIC SOCIETY BULLETIN 60 (3), 355-355		1981
Equations for diffusional creep under multiaxial stress states R Raj	6	1981
Solution-precipitation creep in glass ceramics R Raj, CK Chyung Acta Metallurgica 29 (1), 159-166	360	1981
The Role of Grain-Boundary Sliding in Fracture of Hot-Pressed Si_3N_4 at High Temperatures RL Tsai, R Raj Journal of the American Ceramic Society 63 (9-10), 513-517	91	1980
Creep crack propagation by cavitation near crack tips R Raj, S Baik Metal Science 14 (8-9), 385-394	50	1980
Dynamic effects on flow and fracture during isothermal forging of a titanium alloy H Gegel, S Nadiv, R Raj Scripta Metallurgica 14 (2), 241-246	13	1980
EFFECT OF EXSOLUTION ON CREEP IN THE MAGNESIUM ALUMINUM SPINEL-ALUMINA SYSTEM PED Morgan, FF Lange, R Raj AMERICAN CERAMIC SOCIETY BULLETIN 59 (8), 827-827	4	1980
Use of the double torsion method to study crack propagation in an adhesive layer RH French, R Raj Journal of Testing and Evaluation 7 (3), 160-167	9	1979
The importance of wedge cracking in creep fatigue BK Min, R Raj Canadian Metallurgical Quarterly 18 (2), 171-176	13	1979
Use of the Double Torsion Method to Study Crack Propagation in an Adhesive Layer R Horstman, K Lieb, B Power, R Meltzer, M Vieth, RH French, R Raj		1979

Journal of Testing and Evaluation 7

Report of subgroup on high temperature fracture AS Argon, AG Evans, FF Lange, S Majumdar, R Raj, JR Rice, DMR Taplin, ...		1979
Fatigue mechanisms BK Min, R Raj ASTM Special Technical Publications 675, 569	19	1979
A New Fixture for Fatigue Testing BK Min, R Raj Journal of Testing and Evaluation 7 (1), 24-28	4	1979
Diffusional relaxation of stress concentration at second phase particles RC Koeller, R Raj Acta Metallurgica 26 (10), 1551-1558	103	1978
Life prediction of tungsten filaments in incandescent lamps R Raj, GW King Metallurgical Transactions A 9 (7), 941-946	32	1978
Hold-time effects in high temperature fatigue BK Min, R Raj Acta Metallurgica 26 (6), 1007-1022	76	1978
Nucleation of cavities at second phase particles in grain boundaries R Raj Acta Metallurgica 26 (6), 995-1006	291	1978
Intergranular fracture in bicrystals R Raj Acta Metallurgica 26 (2), 341-349	101	1978
The effect of cycle shape on creep-fatigue interaction in austenitic stainless steels R Raj, BK Min American Society of Mechanical Engineers and Canadian Society for Mechanical …	10	1978
Fracture at elevated temperature W Pavinich, R Raj Metallurgical Transactions A 8 (12), 1917-1933	113	1977
Correction to:“Intergranular fracture at elevated temperature” R Raj, HM Shih, HH Johnson Scripta Metallurgica 11 (10), 839-842	82	1977
INTERGRANULAR FRACTURE AT ELEVATED-TEMPERATURE R Raj, HM Shih, HH Johnson SCRIPTA METALLURGICA 11 (10), 839-842	1	1977
LOW-CYCLE FATIGUE OF 2 AUSTENITIC ALLOYS IN HYDROGEN GAS AND AIR AT ELEVATED-TEMPERATURES R RAJ, CE JASKE, RC RICE JOURNAL OF ENGINEERING MATERIALS AND TECHNOLOGY-TRANSACTIONS OF THE		1977

ASME 99 …

EFFECT OF HOLD-TIME ON ELEVATED-TEMPERATURE FATIGUE CRACK-PROPAGATION IN TYPES 304 AND 316 STAINLESS-STEELS R RAJ, DJ MICHEL, HH SMITH JOURNAL OF ENGINEERING MATERIALS AND TECHNOLOGY-TRANSACTIONS OF THE ASME 99 …		1977
Crack initiation in grain boundaries under conditions of steady-state and cyclic creep R Raj	19	1976
Time Dependent Effects in Creep-Fatigue R Raj Creep-Fatigue Interaction. ASME, New York. 1976, 337-348	4	1976
Measurement of viscosity of the grain-boundary phase in hot-pressed silicon nitride DR Mosher, R Raj, R Kossowsky Journal of Materials Science 11 (1), 49-53	136	1976
De-adhesion by the growth of penny-shaped bubbles in an adhesive layer R Raj, CH Dang Philosophical Magazine 32 (5), 909-922	27	1975
Transient behavior of diffusion-induced creep and creep rupture R Raj Metallurgical Transactions A 6 (8), 1499	144	1975
Intergranular Fracture at Elevated Temperature R Raj, MF Ashby Acta Metallurgica 23, 653-666	974	1975
On the sintering rate of cleavage cracks R Raj, W Pavinich, CN Ahlquist Acta Metallurgica 23 (3), 399-403	28	1975
Creep fracture(hole nucleation and growth in solids at grain boundaries) MF Ashby, R Raj The mechanics and physics of fracture, 148-158	8	1975
High sensitivity creep tester R Raj, YT Chen, F Van Baren Review of Scientific Instruments 45 (12), 1502-1503	5	1974
Use of the internal friction technique to measure rates of grain boundary sliding DR Mosher, R Raj Acta Metallurgica 22 (12), 1469-1474	112	1974
Grain boundary sliding, and the effects of particles on its rate R Raj, MF Ashby Metallurgical and Materials Transactions B 3 (7), 1937-1942	85	1972

On grain boundary sliding and diffusional creep R Raj, MF Ashby Metallurgical transactions 2 (4), 1113-1127	1448	1971
Diffusion-controlled sliding at a serrated grain boundary MF Ashby, R Raj, RC Gifkins Scripta Metallurgica 4 (9), 737-741	73	1970