

R. RAMESH

Distinguished University Professor

Department of Materials Science and Engineering
And Department of Physics

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EDUCATION

1983-1987 M.S, Ph.D. in Materials Science , University of California, Berkeley
1980-1983 B.E. in Metallurgy, Indian Institute of Science, Bangalore, India
1977-1980 B.S. in Chemistry, Madras University, Madras, India

EMPLOYMENT

August 1999-Present Professor, University of Maryland, College Park
Jan. 1995-Aug 1999 Associate Professor, University of Maryland, College Park
Jan.1988-Jan 1995 Member of Technical Staff, Bell Communications Research, Red Bank
Sept.1987-Dec. 1988 Postdoctoral Associate, NCEM, Lawrence Berkeley Laboratory
Aug.1983-Aug.1987 Lawrence Berkeley Laboratory, University of California, Berkeley

RESEARCH INTERESTS

Thin film growth and materials physics of complex oxides: Structure-Property-Processing interrelationships ; Crystalline Oxides on Semiconductors ; Functional metal oxide thin film deposition and processing for microelectronic, magneto-electronic, optical and high frequency applications; **Oxide thin film heterostructures** : growth mechanisms and defect structures; physics of magneto-transport and electro-transport ; half-metallic ferromagnets; transport phenomena in highly correlated systems ; Multiferroic oxide heterostructures ; size effects ; self-assembled oxide nanostructures.

Nanoscale Characterization : Understanding Materials Physics at the nanoscale using **Scanned Probes** ; Applications of scanning force microscopy to study domains, switching and polarization **dynamics** in ferroic thin films ; scaling studies using electric and magnetic force microscopy ; Application of TEM techniques to solving materials problems; high resolution imaging of defect and crystal structure; analytical electron microscopy and micro-diffraction techniques; Lorentz imaging of domains ;

Materials Processing for Devices : Nano-fabrication technologies; novel physical phenomena in complex electronic and magnetic materials with shrinking dimensions; dry etching technologies for device fabrication.

Information Technologies : Non-volatile information storage technologies ; Ferroelectric Memories ; Dynamic Random Access Memories ; Field effect devices ; Thin film magnetic and magneto-resistive devices; CMR thin films and heterostructures ; oxide spin valves and magnetic tunnel junctions.

ACADEMIC HONORS AND PROFESSIONAL AWARDS

Distinguished University Professor, 2003 ; Fellow, American Physical Society, 2001 ; A. James Clark School of Engineering Faculty Outstanding Research Award, 2001 ; Alexander von Humboldt Senior Scientist Prize, 2001 ; International Symposium on Integrated Ferroelectrics, Award for Outstanding Achievement in Integrated Ferroelectrics, 2000 ; Distinguished Research Faculty Fellow, University of Maryland 1999-2000; Bellcore Corporate Award, 1994, 1993, 1992 ; Earl R. Parker Fellowship, American Society for Metals, 1987; Graduate Student Award, Materials Research Society , 1987 ; Ross M. Tucker Award, Intel Corporation and N. California Chapter of AIME, 1986-1987 ; James Monroe McDonald Scholarship, 1986-1987 ; Regent's Fellowship, University of California, Berkeley, 1984-1985; Vidya Bharati Award in Metallurgy, Indian Institute of Metals, 1983 ; K.K.Mullick Gold Medal in Metallurgy, 1983 ; National Merit Scholarship during B.E., 1980-1983 ; College Gold Medal, 1980 ; National Merit Scholarship during B.Sc, 1977-1980.

PUBLICATIONS, TALKS AND PATENTS

Over 250 papers, reviews and monographs covering magnetic materials, recording materials, magnetic and magnetoresistive metal oxides, high temperature superconductors, ferroelectrics, dielectrics, piezoelectrics and relaxors, semiconductor heterostructures and advanced transmission electron microscopy techniques applied to materials characterization. **Over 8000 citations that place him in the top-300 (among approximately 270,000 worldwide).**

Journals include Science, Nature, Applied Physics Letters, Journal of Applied Physics, Journal of Materials Research, Integrated Ferroelectrics, Journal of Magnetism and Magnetic Materials, Annual Reviews of Materials Science, Physical Review Letters, Physical Review B, Materials Science and Engineering B, JI. of Electronic Materials, Journal of Electroceramics

Presented over 50 Invited talks at International Conferences, Symposia and Workshops.

16 Patents issued and 11 filed.

PROFESSIONAL ACTIVITIES

Member: Materials Research Society, American Physical Society, ASM/TMS;

Editorial Board: "Integrated Ferroelectrics" Journal of Electroceramics ; International Advisory Board for the International Symposium on Integrated Ferroelectrics ; Member of Editorial Board, Journal of Applied Physics and Applied Physics Letters (1998-2001) ; JI. of Electroceramics ; Journal of Materials Research. Member of TMS John Bardeen Award Committee

Journal Review : Science, Nature, JI. of Appl. Phys., Appl. Phys. Lett., JI. of Materials Research, JI. of Electronic Materials ; JI. of Electroceramics ; Thin Solid Films.

Symposium Co-Organization: International Conference on Electronic Materials, 1990; MRS Symposia " Defect structure in oxide thin films", April 1992; " Epitaxial oxide thin films and heterostructures", April 1994; " Ferroelectric thin films IV", December 1994; " Ferroelectric thin films V", April 1996 ; International Oxide Electronics Workshop, 1997, 1998 and 1999 ; APS March Meeting Focus Topic Symposium on Dynamics in Ferroelectrics and Dielectrics, 2001 and 2002 ; MRS Fall Symposium on Polarization Dynamics in Ferroic Materials, 2001 ;

Technical Program Chair, International Symposium on Integrated Ferroelectrics-1999, 2003

Program Review : National Science Foundation SBIR Programs ; MRSEC Programs ; Program for Women in Engineering ; International Programs ; Department of Energy Program Reviews

Consultant : Bellcore, Motorola, Candescant, Inc., Tachyon Semiconductor, Intematix Corporation, Sponsera, Inc., Fujitsu, Solid State Photonix, Spectalis, Inc.

SUMMARY OF KEY RESEARCH ACCOMPLISHMENTS

Professor Ramesh's work over the past 10+ years has spanned a broad range of **novel** metal oxide materials, with a specific focus on the **Science** and **Technology** of functional multicomponent perovskites. He has made numerous pioneering contributions pertaining to thin film growth by pulsed laser deposition, creation of novel device structures and their characterization using advanced probes. In 1988-89, his effort was among the first to identify **the atomic structure of defects** in YBCO thin films and the structure and chemistry of the "2223" BSCCO superconductor. His original electron microscopy studies led to the **template** approach for the growth of a-axis oriented YBCO films.

His landmark contributions in **ferroelectric** perovskites came through the recognition that **conducting oxide electrodes** are the solution to the problem of polarization **fatigue**, which for 30 years, remained an enigma and unsolved problem. This contribution is now recognized worldwide with many industrial and research laboratories implementing such an approach. His original demonstration came through the use of epitaxial perovskite thin films deposited by pulsed laser deposition. He soon extended this to polycrystalline films, deposited by pulsed laser deposition as well as by sputtering, thus paving the way for a commercially viable, reliable ferroelectric memory technology. His subsequent work in the area of ferroelectric thin films has led to several highly cited, **seminal** contributions, including : novel **template** approaches to control the crystallographic orientation of cubic perovskites ; the understanding of the impact of **point defects** on ferroelectric properties ; on the use of **piezo force microscopy** (PFM) to understand the nanoscale origins of polarization relaxation in single grains, and a very unique combination of PFM and focused ion beam lithography (FIB) to enable an understanding of the **scaling** laws governing the ferroelectric polar state. He currently leads a MRSEC Interdisciplinary Research Group that is focused on understanding the materials physics and polarization dynamics in ferroelectric and dielectric thin films.

In 1994, in collaboration with S. Jin (Lucent Technologies), he initiated research into manganite thin films and they coined the term, **Colossal Magnetoresistive (CMR) Oxides ; the paper published in Science is the 4th highest cited paper (more than 1500 citations)**. This work was the starting point for an intense international R&D effort on these materials, with several promising approaches for new devices. At Maryland, he continues to pursue key scientific and technological problems in half metallic magnetic oxides within a framework of multicomponent oxide thin films and heterostructures. His work in this field has also led to the discovery of novel field effect devices that combine the properties of ferroelectric and magnetic perovskites. He has published over 250 papers in many internationally reputed journals including Science, Nature, Physical Review Letters, Applied Physics Letters, Physical Review B, Journal of Applied Physics and the Journal of Materials Research. He has been issued 16 patents with 11 more under consideration. He has organized several international conferences and symposia under the MRS framework, in the area of multicomponent oxides. He served on the Editorial Board of Journal of Applied Physics, Applied Physics Letters, and is currently on the editorial board of Integrated Ferroelectrics, Journal of Materials Research and Journal of Electroceramics. His work is cited extensively (**over 8000 citations**), which ranks among the top 300 physicists around the world in the Physics Citation Index. The fact that he is in the **top 300** worldwide, in spite of the short time that he has been active in physical sciences (approximately 10 years) is testament to the high quality and impact of his research work. His pioneering work in the field of multicomponent oxides has been recognized worldwide. He was honored by the International Symposium on Integrated Ferroelectrics with an **Outstanding Achievement Award** in 2000. In **2001**, he was awarded the **Humboldt Senior Scientist Prize** by the Alexander von Humboldt Foundation, the **A. James Clark School of Engineering Faculty Outstanding Research Award** and **Fellowship** in the **American Physical Society**.

UNDERGRADUATE, GRADUATE AND POSTDOCTORAL RESEARCHERS

NAME	YEAR	DEGREE	Present Address
A. Pique	1996	Ph.D.	NRL
M.S.Krupashankara	1996	M.S.	Private Business, India
B. Yang	1997	Ph.D.	Hynix, S.Korea
S. Sharath	1997	M.S.	Consulting
S. Madhukar	1998	Ph.D.	Intel
A.S. Prakash	1998	M.S.	I2
M. Robson	1999	Ph.D.	NSA
J. Gu	1999	Ph.D.	Argonne NL
K. Nagodawithana	1999	M.S. (non thesis)	NSA
I. Jenkins	2000	Ph.D.	TI
W. Tipton	2000	Ph.D.	Army Research Laboratory
C. Ganpule	2001	Ph.D.	Intel
V. Nagarajan	2001	Ph.D.	Humboldt Fellow, RWTH, Aachen
B. Hill	2001	M.S.	Law School
H. Li	2001	Ph.D.	Motorola
R. Godfrey	2002	Ph.D.	NRC Fellow, NRL

AFFILIATED Ph.D.'s (Graduate students who did their Ph.D. in my group but got their degree outside of UMCP) :

S. Shinde	1999	Ph.D.	Research Scientist, UMCP
L. Saraf	1999	Ph.D.	Research Scientist, PNNL

CURRENT STUDENTS

NAME	EXPECTED DATE	TOPIC
J.L. Wang	2004	Ph.D., Multiferroic perovskites
H. Zheng (w/L.S. Riba, Motorola)	2004	Ph.D., Multiferroic Nanostructures
S. Yang	2004	Ph.D. Ultrathin PZT by CVD
S. Prasertchoung	2004	Switching dynamics using AFM
J. Ouyang	2004	Nanoscale piezomechanics
Z. Ma (w/J. Melngailis)	2004	90° domain dynamics
J.J. Li (w/Chi Lee)	2003	Ultrafast switching dynamics
L. Mohaddes	2004	Self assembled nanostructures

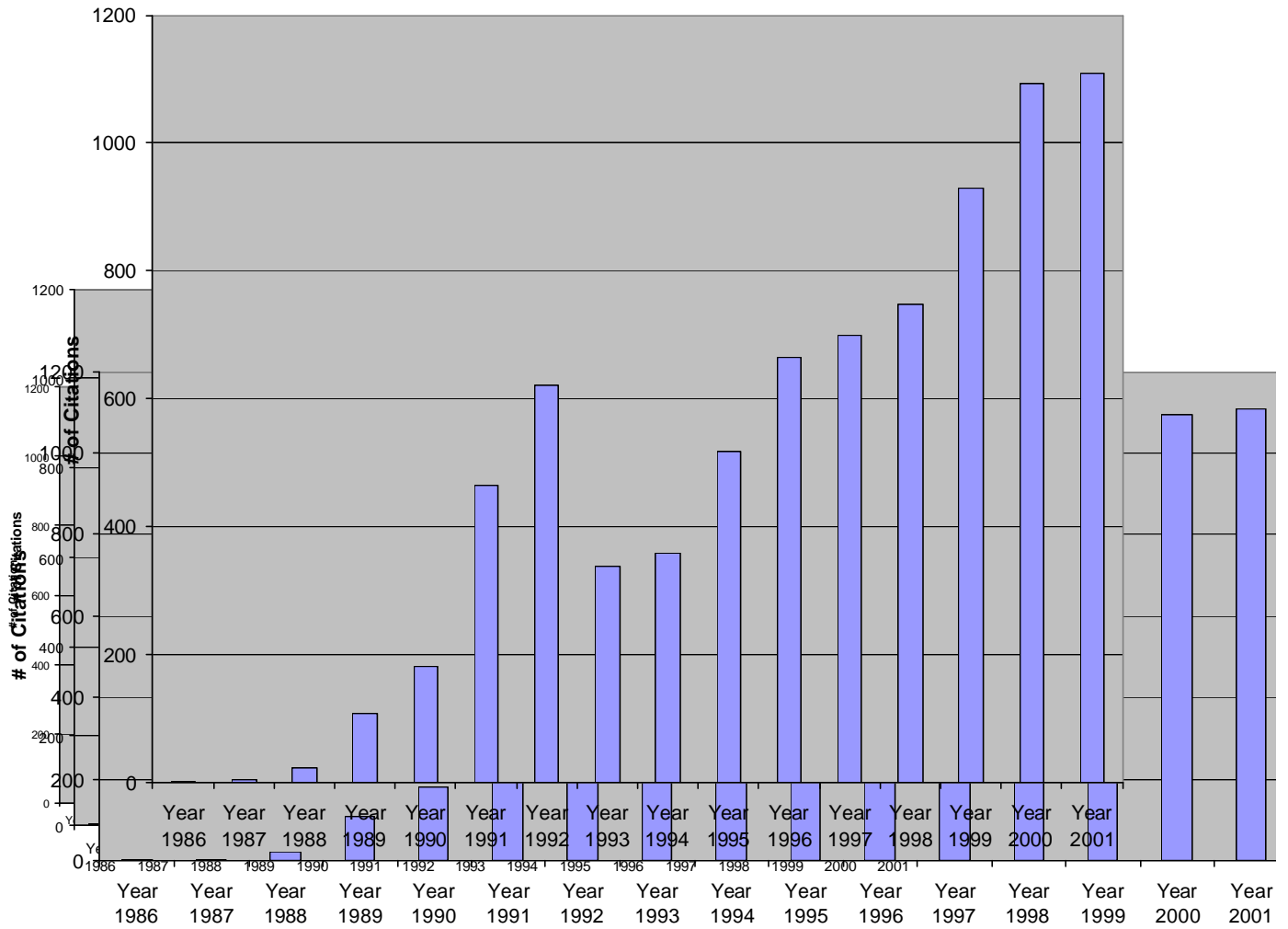
POSTDOCTORAL RESEARCHERS

A. Dhote	1995-1999	Argonne NL
S. Aggarwal	1996-2000	TI
T.K.Song	1996-1998	Chongnam University
C.Kwon	1995-1998	Cal. State Univ., Northridge
M. Sastry	1998-1999	NCL, India
L.Saraf	1999-2000	PNNL
C. Canedy	1997-1999	Intel ; NRL
G.Y. Yang	1999-2000	Penn. State (postdoctoral)
V.Novikov	1999-2000	U. Nizhny Novigrad
B. Nagaraj	1998-2001	CSR, UMCP
P.Alpay (w/A. Roytburd)	1999-2000	Asst. Prof., U. Conn.
A. Stanishevsky((w/J.Melngailis)	1998-2002	Asst. Prof., Alabama, Birmingham
B. Liu	1999-2002	VCU
V. Nagarajan	2001-2003	RWTH, Aachen, IWE, Juelich
T. Zhao	2002-	
A. Tselev (w/S. Anlage)	2001-	Scanning microwave microscopy

UNDERGRADUATE RESEARCHERS

NAME	YEARS	RESEARCH TOPIC
S. Sauvage	1995-1996	Imprint in ferroelectric films
S. Perusse	1996-1999	Hydrogen effects in ferroelectrics
T. Sawhney	1996-1999	Sputtering of oxide materials
M. Cardenas	1997-1999	PLD studies of pyroelectric oxides
A. Martinez	1997-1999	Transport studies in pyroelectrics
B. Bamburak	1999-2000	Sputtering of oxide electrodes
B. Biss	1999-2000	Transport studies in ferroelectrics
M. Burr	1999-2000	PLD of ceramic coatings
C. Kerr	1997-1999	PLD of ferroelectrics
A. Monga	1997-1999	Self assembled nanostructures
T. Tran	1999-2001	PLD studies of BST films
A.V. Cresce	1999-2000	PLD of borides, carbides
D. Tom	1999-2000	PLD of magnetic oxides
M. Vornebrock	2000-	Ferromagnetic Intermetallics on GaAs.
R. Sreshta	2000-	High speed electrical measurements in ferroelectric devices, PFM
S. De	2000-2002	PLD of self assembled nanostructures
S. Ayeni	2001-2002	CVD of complex oxides
H. Vu	2001-	Sputtering of oxides

Annual Citations



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Professor

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LIST OF PUBLICATIONS

REVIEW ARTICLES : 1983 - 1995

R.Ramesh, J.K.Chen, L.K.Rabenberg and G.Thomas, "Microstructure and properties of rare earth magnets", **Proc. ASM Symposium on Hard and Soft Magnetic Materials and Applications**, Cincinnati, Ohio, 12-17 Oct., 1987.

R.Ramesh, G.Thomas and B.M.Ma, "Dy-Al sintering additive :Effect on microstructure and magnetic properties of Fe-Nd-B magnets, **Symposium L - Microstructure Property Relationships in Magnetic Materials**, Materials Research Society International Meeting on Advanced Materials, May 30- June 3, 1988, Tokyo Japan.

G.Thomas and R.Ramesh, "Atomic Imaging and Microanalysis of Ceramics", **Proc. of American Ceramic Society** Fall Meeting, San Francisco, CA, Oct., 1988.

R.Ramesh, S.M.Green and G.Thomas, "Microstructure-Property relationships in Bi(Pb)-Sr-Ca-Cu-O ceramic superconductors", published as a chapter in **Science of High Temperature Superconductors, Vol.5**, Nova Science Publishers, New York, 1989.

R.Ramesh, " New Permanent Magnets", a chapter in **Encyclopedia of Science and Technology, 1991 Yearbook**, published by Academic Press.

R.Ramesh, A.Inam, T.D.Sands and C.T.Rogers, "Thin films of high Tc superconductors: Growth and characterization " **Materials Science and Engineering, B.14**, 188-213(1992).

A.F.Marshall and R.Ramesh, " Microstructure of interfaces in high temperature superconductor thin films", published as a chapter in **Interfaces in High Tc systems**" Eds. S.Shinde and D.A.Rudman, published by Springer-Verlag.

R.Ramesh, "Ferroelectric and Ceramic Thin Films by Laser Ablation", in **Encyclopedia of Advanced Materials**, Pergamon Press, New York, 1993.

R.Ramesh, T.Sands and V.G.Keramidas, " The template approach to heteroepitaxy", in **Encyclopedia of Advanced Materials**, Pergamon Press, New York, 1993.

R.Ramesh, "Transmission electron microscopy of oxide thin films", in **Proc. of NATO Advanced Study Institute on Multicomponent and Multilayered Thin Films for Advanced Microtechnologies : Techniques, Fundamentals and Devices**, Eds. O.Auciello and J.Engemann, Kluwer Academic Publishers, The Netherlands, 1993.

O.Auciello, R.Dat and R.Ramesh, "Pulsed Laser Ablation Synthesis and Characterization of Ferroelectric Thin Film Heterostructures", chapter in **Integrated Ferroelectrics**, Eds. G.Taylor, C.A.Paz de Araujo and J.F.Scott, Gordon and Breach Publishers, 1993.

R.Ramesh, V.G.Keramidas, O.Auciello and R.Dat, "Ferroelectric metal oxide heterostructures", in Proc. of NATO Advanced Research Workshop, Villa Del Mare, Italy, June 1994.

R.Ramesh and V.G.Keramidas, "Ferroelectric Metal Oxide Heterostructures", in **Annual Reviews of Materials Science**, Vol.25, Ed., B.Wessels, et.al.,(1994).

SOME KEY PUBLICATIONS (OUT OF ~120) : 1983- 1995

FERROELECTRIC MEMORIES, THIN FILMS

R.Ramesh, A.Inam, W.K.Chan, B.Wilkens, K.Myers, K.Remschnig, D.L.Hart and J.M.Tarascon, "Epitaxial cuprate superconductor ferroelectric heterostructures", **Science**, 252, 944(1991).

R.Ramesh, et.al., "Fatigue and retention in YBCO/PZT/YBCO heterostructures ", **Appl. Phys. Lett.**, 61, 1537(1992).

R.Ramesh, H.Gilchrist, T.Sands, V.G.Keramidas, R.Haakenaasen and D.K.Fork, "Ferroelectric La-Sr-Co-O/Pb-Zr-Ti-O/La-Sr-Co-O heterostructures on Silicon via template growth ", **Appl. Phys. Lett.**, 63, 3592(1993).

R.Ramesh, T.Sands and V.G.Keramidas, "Template approaches to growth of oriented oxide heterostructures on SiO₂/Si", **Jl. of Electronic Materials**, 23, 19(1994).

R.Ramesh, B.Dutta, T.S.Ravi, J.Lee, T.Sands and V.G.Keramidas, "Scaling of ferroelectric properties in LSCO/PLZT/LSCO capacitors", **Appl. Phys. Lett.**, 64, 1588(1994).

J.S.Speck, A.Siefert, W.Pompe and R.Ramesh, "Domain configurations due to multiple misfit relaxation mechanisms in epitaxial ferroelectric thin films. II. Experimental verification and implications", **Jl. of Applied Physics**, 76, 477(1994).

MAGNETIC MATERIALS

R.Ramesh and K.Srikrishna, "Magnetization reversal in nucleation controlled magnets, Part I: Theory", **Journal of Applied Physics**, 64, 6406(1988).

R.Ramesh, G.Thomas and B.M.Ma, "Magnetization reversal in nucleation controlled magnets, Part II: Effect of grain size and size distribution on intrinsic coercivity of Fe-Nd-B magnets", **Journal of Applied Physics**, 64, 6416(1988).

R.Ramesh and G.Thomas, "Inter-relationships between structure and property in magnetic materials", **Materials Science and Engineering**, B3, 435(1989).

MAGNETORESISTIVE MATERIALS AND DEVICES

S.Jin, T.H.Tiefel, M.McCormack, R.Fastnacht, R.Ramesh and L.H.Chen, "Thousandfold resistivity change in magnetoresistive La-Ca-Mn-O films", **Science**, 264, 413(1994).

SEMICONDUCTOR HETEROSTRUCTURES

T.D.Sands, C.J.Palmstrom, J.P.Harbison, V.G.Keramidas, N.Tabatabaie, T.L.Cheeks, R.Ramesh and Y.Silberberg, "Stable and epitaxial Metal/III-V semiconductor heterostructures", **Materials Science Reports**, Vol.5, No.3 (1990).

T.Sands, J.P.Harbison, M.L.Leadbeater, S.J.Allen,Jr., G.W.Hull, R.Ramesh and V.G.Keramidas, "Epitaxial ferromagnetic t-MnAl films on GaAs", **Appl. Phys. Lett.**, 57, 2609(1990).

OXIDE SUPERCONDUCTORS, BULK

R.Ramesh, G.Thomas, S.M.Green, M.L.Rudee and H.L.Luo, "Structure and composition of the 115 K superconducting phase in the Bi-Ca-Sr-Cu-O system", **Appl. Phys. Letters**, 53, 520(1988).

R.Ramesh, S.Jin and P.Marsh, "A new "125" defect phase in phase decomposed Y₂Ba₄Cu₈O₁₆ bulk superconductors", **Nature**, 346, 420(1990).

OXIDE SUPERCONDUCTORS, THIN FILMS

R.Ramesh, A.Inam, W.A.Bonner, P.England, B.J.Wilkens, B.J.Meagher, L.Nazar, X.D.Wu, M.S.Hegde, C.C.Chang, T.Venkatesan and H.Padamsee, "Ferrimagnetic rare earth orthoferrites : a new magnetic substrate for the growth of epitaxial Y-Ba-Cu-O thin films", **Appl. Phys. Lett.**,55, 1138(1989).

R.Ramesh,D.M.Hwang, T.Venkatesan, T.S.Ravi, L.Nazar, A.Inam, X.D.Wu, B.Dutta, G.Thomas, A.F.Marshall and T.H.Geballe, "Direct observation of structural defects in laser deposited thin film Y-Ba-Cu-O superconductor", **Science**,247, 57(1990).

R.Ramesh, C.C.Chang, X.X.Xi, T.S.Ravi, D.M.Hwang, Q.Li, A.Inam, X.D.Wu and T.Venkatesan, "Structural perfection of Y-Ba-Cu-O thin films controlled by the growth mechanism", **Appl. Phys. Lett.**, 57, 1064(1990).

R.Ramesh, A.Inam, D.M.Hwang T.D.Sands, C.C.Chang and D.L.Hart, "The surface outgrowth problem in c-axis oriented Y-Ba-Cu-O thin films", **Appl. Phys. Lett.**,58, 6532(1991).

MISCELLANEOUS

R.Ramesh, J.Glazer, M.R.Hilton, and M.Sarikaya, Comparison of convergent beam electron diffraction methods for determination of foil thickness", **Phil. Mag.**, Vol.52(A), No.6, L59-L63(1985).

C.J.Sandroff, J.P.Harbison, R.Ramesh, M.J.Andrejco, M.S.Hegde, D.M.Hwang, C.C.Chang and E.M.Vogel, "GaAs clusters in the quantum size regime : growth on high surface area silica by molecular beam epitaxy", **Science**, 245, 391(1989).

PUBLICATIONS (1995-2002) : UNIVERSITY OF MARYLAND

(a) Books, Book Chapters and Monographs :

1. "Ferroelectric and dielectric thin films and devices" Edited by R.Ramesh, Kluwer Academic Publishers, 1997.
2. Annual Reviews of Materials Science, Eds. O. Auciello and R.Ramesh, Vol. 28(1998).
3. S. Aggarwal and R.Ramesh, "Point defect chemistry of metal oxide heterostructures", in Annual Reviews of Materials Science, Eds. O. Auciello and R.Ramesh, Vol. 28, 463-500(1998). O.Auciello, C.M.Foster and R.Ramesh, " Processing technologies for ferroelectric thin films and heterostructures", in Annual Reviews of Materials Science, Eds. O.Auciello and R.Ramesh, Vol. 28, 501-562(1998).
4. R.Ramesh, S.B.Ogale, M.Rajeswari, R.L.Greene and T.Venkatesan, "Colossal magnetoresistive manganites : the push towards low field magnetoresistance", review article in Magnetoresistive Metal Oxides, Edited by C.N.R.Rao, 155-188(1998), World Scientific Publishers, Singapore.
5. R.Ramesh and T.Venkatesan, "Magnetoresistance : CMR", in Wiley Encyclopedia of Electrical and Electronics Engineering, Ed. J.G.Webster, John Wiley & Sons, NY 1998.
6. J.F.Scott, O.Auciello and R.Ramesh, "The Physics of Ferroelectric Memories", Special article in Physics Today, 1998.
7. A.Gruverman, O.Auciello, R.Ramesh and H.Tokumoto, : "Scanning force microscopy of domain structure in ferroelectric thin films : Imaging and Control", Nanotechnology 8 (1997), in press.
8. O.Auciello, A.Gruverman, H.Tokumoto, S.A.Prakash, S.Aggarwal and R.Ramesh, " Studies of polarization phenomena in ferroelectric thin films via direct nanoscale scanning force imaging microscopy", in special issue of Materials Research Bulletin, January 1998.
9. S.Aggarwal, B.Yang and R.Ramesh, " Low voltage performance in PZT thin films through lattice engineering", in "Ferroelectric and dielectric thin films and devices" Edited by R.Ramesh, Kluwer Academic Publishers, August 1997.
10. "Electroceramic Thin Films I&II", O.Auciello and R.Ramesh, Guest Editors, Materials Research Society Bulletin, June, July 1997.
11. C. A. P. Araujo, O. Auciello and R. Ramesh, " Science and Technology of ferroelectric films and heterostructures for nonvolatile ferroelectric memories : Past eleven years and the future", Keynote article in "Science and Technology of Ferroelectric Thin Films ", Gordon and Breach Publishers, 2000.
12. R. Ramesh, S. Aggarwal and O. Auciello, " Science and technology of ferroelectric films and heterostructures for nonvolatile ferroelectric memories", Materials Science and Engineering Report, R32, (2001).

(b) Articles in Refereed Journals :

SCIENCE, NATURE :

12. S.Matthews, R.Ramesh, T.Venkatesan and J.Benedetto, "Ferroelectric field effect transistor based on epitaxial perovskite heterostructures", Science 276, 238(1997).

13. J.H.Park, E.Vescovo, H.J.Kim, C.Kwon, R.Ramesh and T.Venkatesan, "Direct evidence for a half-metallic ferromagnet" *Nature*, 392, 794(1998).
14. S. Aggarwal, A.P. Monga, S.R. Perusse, R. Ramesh, V. Ballarotto, E.D. Williams, B.R. Chalamala, Y. Wei and R.H. Reuss, "Spontaneous Ordering of Oxide Nanostructures," *Science* 287, .2285(2000).
15. V. Nagarajan, et al., "Dynamics of ferroelastic domains in ferroelectric thin films" *Nature (Materials)*, in press, Dec., 2002.
16. J.L.Wang et al., " Epitaxial BiFeO₃ Multiferroic Thin Film Heterostructures", *Science*, in press.
17. J.J.Li, et al., "Ultrafast polarization dynamics in thin ferroelectric films", submitted to *Nature Materials*.

PHYSICAL REVIEW LETTERS, PHYSICAL REVIEW B :

18. R.P.Sharma, G.C.Xiong, C.W.Kwon, R.Ramesh, R.L.Greene and T.Venkatesan, "Direct evidence of the role of lattice distortions in the transport property of perovskite-type manganite films", *Phys. Rev. B* 54, 10014(1996).
19. S.B.Ogale, V.Talyansky, C.H.Chen, R.Ramesh, R.L.Greene and T.Venkatesan, "Unusual electric field effects in NSMO", *Phys. Rev. Lett.*, 77, 1159(1996).
20. S.G. Kaplan, M.Quijada, H.D.Drew, D.B.Tanner, G.C.Xiong, R.Ramesh, C.Kwon and T.Venkatesan, "Optical evidence for the dynamic Jahn-Teller effect in NSMO", *Phys. Rev. Lett.* 77, 2081(1996).
21. J.H.Park, E.Vescovo, H.J.Kim, C.Kwon, R.Ramesh and T.Venkatesan, "Magnetic properties at surface boundary of a half-metallic ferromagnet manganese perovskite" *Physical Review letters*, 81, 1953(1998).
22. S.B.Ogale, K.Ghosh, R.P.Sharma, R.L.Greene, R.Ramesh and T.Venkatesan, "Magnetotransport anisotropy effects in epitaxial Fe₃O₄ thin films", *Phys. Rev. B*, in press.
23. T.Freissnegg, S.Madhukar, B.Nielsen, A.R.Moodenbaugh, S.Aggarwal, D.J.Keeble, E.H.Poindexter and R.Ramesh, "Metal ion and oxygen vacancies in bulk and thin film LSCO", *Phys. Rev.B*.59, 13365(1999).
24. M.Quijada, J.Cerne, J.R.Simpson, H.D.Drew, K.H.Ahn, A.J.Millis, R.Shreekala, R.Ramesh, M.Rajeswari and T.Venkatesan, "Optical conductivity of manganites : Crossover from Jahn-Teller small polaron to coherent transport in the ferromagnetic state", *Phys. Rev. B* 58, 16093(1998).
25. Y.G.Zhao, J.J.Li, R.Shreekala, H.D.Drew, C.L.Chen, W.L.Cao, C.H.Lee, M.Rajeswari, S.B.Ogale, R.Ramesh, G.Bhaskaran and T.Venkatesan, " Ultrafast laser induced conductive and resistive transients in LCMO : Charge transfer and relaxation dynamics", *Phys. Rev. Lett.*, 81, 1310(1998).
26. K.Ghosh, S.B.Ogale, R.Ramesh, R.L.Greene, T.Venkatesan, K.M.Gapchup, R.Bathe and S.I.Patil, "Transition element doping effects in LCMO", *Phys. Rev.B*59,533(1999).
27. B.Nagaraj, S.Aggarwal, T.K.Song, T.Sawhney and R.Ramesh, "Leakage current mechanisms in lead based thin film ferroelectric capacitors", *Phys. Rev.B*, 59, 16022 (1999).
28. T. Wu et al., " Colossal electroresistance and electronic phase separation in mixed valent manganites", *Phys. Rev. Lett.*, 86,5998(2001).
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2. "Pulsed Laser Deposited Superlattices Based on Perovskite Oxides", C. Kwon, et.al., invited talk at International Conference on Superlattices, Microstructures, and Microdevices (ICSMM-8), August 21 - 25 1995, Cincinnati, OH.
3. "Magnetic oxide thin film heterostructures" Invited presentation at NIST, June 1995.
4. "Metal oxide heterostructures" Short course at the MRS Fall Meeting, Boston, MA, Dec., 1995.
5. "Metal Oxide Heterostructures" Invited talk in Department of Electrical Engineering, Ohio State University, February 1995.
6. "Ferroelectric oxide thin film heterostructures", in North Carolina section of MRS, Nov. 1995.
7. R. Ramesh, B. Simion and G. Thomas, "Epitaxial magnetic garnet heterostructures", in 7th Int. Conf. on Ferrites, Bordeaux, France, August 1996.
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9. "Process integration of ferroelectric thin films for nonvolatile memories" in International symposium on applications of ferroelectric thin films" Hamamatsu, Japan, September 1996.
10. R. Ramesh, "Ferroelectric thin films and heterostructures" in Int. Meeting on Ferroelectrics, Seoul, Korea, 1997.
11. R. Ramesh, "Conducting barrier layers for high density memories" in MRS Fall Meeting Symposium on Ferroelectric Thin Films, Boston, MA 1997.
12. R. Ramesh, "Metal oxide heterostructures", Rutgers University, March 1997.
13. S. Aggarwal and R. Ramesh, "Process integration studies of ferroelectrics on Si with conducting barrier layers", In Ninth Int. Symp. on Integrated Ferroelectrics, Santa Fe, NM, March 1997.
14. S. Aggarwal and R. Ramesh, "LSCO electrodes for ferroelectric memories : point defects and reliability issues", In Fourth Int. Oxide Electronics Workshop, College Park, MD, Dec., 1997.
15. R. Ramesh, "Ferroelectric Memories", Invited lecture at Fujitsu, Tokyo, JAPAN, March 1997.
16. R. Ramesh, "Science and Technology of PZT thin films for NVFRAMS ", Plenary lecture at ISIF-98, Monterey, CA, March 1998.
 - I. R. Ramesh, "Basic and applied studies of ferroelectric thin films", in Fifth Williamsburg Workshop on First-Principle Calculations for ferroelectrics", Ed. R.E. Cohen, 1998.
 - II. R. Ramesh, "Conducting barrier layers for direct integration of ferroelectric thin films on Si", MRS Fall Meeting Symposium on Ferroelectric Thin Films, Boston, MA, December 1998.
 - III. M. Robson and R. Ramesh, " Colossal Magnetoresistive Oxides: Push towards low field magnetoresistance", in ISAF, Montreaux, Switzerland, June 1998.

- IV. R. Ramesh, "Interfaces in ferroelectric thin films", in Workshop on Interfaces, San Diego, CA, October 1998.
- V. R. Ramesh, "Polarization dynamics in ferroelectric thin films", in 6th Int. Oxide Electronics Workshop, College Park, MD, Dec 1999.
- VI. S. Aggarwal and R. Ramesh, "Conducting barrier layers for high density memories", Invited talk at ISIF-1999, Colorado Springs.
- VII. S. Aggarwal and R. Ramesh, "Barrier layers for integration of ferroelectric capacitors on Si", Int. Conf. On Met. Coatings and Thin Films, San Diego, CA 1999.
- VIII. S. Aggarwal and R. Ramesh, "Fundamental and applied studies of ferroelectric thin films", in IUMRS-ICAM Meeting, Beijing, China, 1999
- IX. R. Ramesh, "High density ferroelectric memories", in FWPR'99, Puerto Rico, 1999.
- X. R. Ramesh and L. Salamanca-Riba, "Domains in ferroelectric thin films and heterostructures", In TMS Annual Meeting Symposium on Twinning.
- XI. R. Ramesh, "Fundamental and applied studies of ferroelectric thin films", Colloquium at NEC, Princeton, February 1999.
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- XIV. R. Ramesh, "Fundamental and applied studies of ferroelectric thin films", in Aspen Workshop on Ferroelectrics, Aspen, CO February 2000.
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- XIX. C. Ganpule and R. Ramesh, "Nanoscale dynamics in ferroelectric thin films", in ISIF-2001, Colorado Springs, CO, March 2001.
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- XXVI. R. Ramesh, "Fundamental and applied studies of ferroelectric thin films", in Williamsburg Workshop on Ferroelectrics, Williamsburg, VA, February 2001.

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- XXX. R. Ramesh, "Defects in Perovskite oxides thin films", American Ceramic Society Annual Meeting, Cincinnati, OH , April 2001.
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