

## **Pradeep Kumar Rohatgi**

State of Wisconsin and UWM Distinguished Professor  
Director of UWM Composites Center and UWM Center for Advanced Materials Manufacture  
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### **Education**

Doctor of Science in Metallurgy, Massachusetts Institute of Technology (1964).  
Master of Science, Massachusetts Institute of Technology (1963).  
Bachelor of Science, Banaras University (1961).

### **Appointments**

2010 Professor, Department of Mechanical Engineering, UWM.  
2009 Director, Center for Advanced Materials Manufacture (CAMM), UWM  
2007 University of Wisconsin-Milwaukee, Distinguished Professor  
1996 State of Wisconsin Distinguished Professor, UWM  
1994 Foundry Education Foundation Key Professor  
1991 Ford/Briggs and Stratton Chaired Professor, UWM  
1988-90 Samuel C. Weaver Chaired Professor, UWM  
1986-89 Visiting Professor, Materials Science and Engineering, M.I.T

### **Positions Held**

1986-Present Tenured Full Professor, Materials Department, College of Engineering and Applied Science, University of Wisconsin–Milwaukee, Milwaukee, Wisconsin. Founder and Director of Research of Laboratories for Foundry, Solidification, and Tribology at UWM, and UWM Center for Composites. Appointed professor, Department of Mechanical Engineering, UWM in 2010 (In addition to materials).

**Developed new courses on solidification, composites, and metal casting. Established the UWM Composites Center, foundry and tribology laboratories, and the Center for Advanced Material Manufacture, which helped develop world leadership in lightweight materials for civilian and military transportation systems. Received over 10 million dollars in research funding for UWM. Supervised research for a very large number of master's and doctorate students and postdoctoral fellows on topics related to materials for transportation systems. Provided consulting services to industries manufacturing lightweight materials for transportation.**

1977-1986 Founder Director (Equivalent to President and Chief Executive Officer in the US) of the National Institute of Interdisciplinary Science and Technology (Trivandrum) and the Advanced Materials and Processes Research Institute (Bhopal), Council of Scientific and Industrial Research, India. (Both are equivalent to National Laboratories in US with large numbers of scientific and administrative staff).

**Conceived goals, set up, and directed research at two new national research laboratories, and worked on regional industrial needs and local resources, solidification, alloy development and composites. Both of these laboratories have blossomed into first-rate research institutions as a result of his initial service as Founder/Director. Pioneered the formulation of national and regional policies for science and technology, developed several new natural fiber and metal matrix composites, and coauthored a book and a large number of papers. Involved in the formulation of national and regional policies for technology and education.**

Concurrently Visiting Full Professor I.I.T., Delhi, and Bhopal University, 1982-1984, and Visiting Full Professor, Indian Institute of Science (Bangalore), 1977-1980; Visiting Full Professor, University of California, 1983 (Fall).

1972-1977 Full Professor, Division of Mechanical Sciences, Indian Institute of Science, Bangalore, in Departments of Mechanical Engineering, Metallurgy, and Industrial Management, and Director of Foundry Lab, Composites Lab and Technology Forecasting and Management Center.

**Taught graduate and undergraduate courses in materials science, solidification, composites, technology forecasting, and materials policy. Guided doctoral and masters thesis research. Was involved in development of National and Regional policies on Technology and Education for the future. Developed several new composites using uncoated ceramic reinforcements, wrote a book, and developed a center on technology forecasting with lasting impacts on sustainable technology policy.**

1969-1972 Research Engineer, Homer Research Laboratory  
Bethlehem Steel, Bethlehem, Pennsylvania.  
Research in Alloy Development, Castings, Composites

**Developed new metal matrix composites. Solved problem of defects in composite steel castings.**

1968-1969 Visiting Faculty, Indian Institute of Technology, Kanpur, India Teaching and research in Composites, Castings

**Synthesized copper and aluminum based composites, resulting in two patents. Guided research students.**

1964-1968 Research Metallurgist, Merica Research Laboratory,  
International Nickel, Suffern, New York  
Research in Composites, Castings and Alloy Development

**Worked out the physics of transfer of reinforcements across the gas-liquid and solid phases leading to the first synthesis of cast matrix aluminum in composites, which became a landmark in 11,000 year history of Metal Castings. Obtained two patents and coauthored a paper which received best paper award from AFS.**

## Industrial Uses of Metal Matrix Composites in the Transportation Industry, Inspired by the Professor's Research

- Lower Drag Brace for the F16 - Ti-SiC
- Lightweight Composite Core for Power Lines (CTC) Al-composite core
- Brake rotors for German high speed train ICE-2 Al-Si, Mg and SiC
- Cylinder liner – LOKASIL-composite used in Porsche Boxter
- Space Shuttle Orbiter Main Cargo Bay Struts – Aluminum Composite
- Hubble Space Telescope Antenna Waveguide Mast – 6061/C melt infiltration P-100 carbon fibers
- Spartan Auxiliary Mounting Plate
- Hubble Space Telescope Antenna Waveguide Mast – 6061/C melt infiltration P-100 carbon fibers
- F-16 Fuel Access Door Covers - 6092/SiC/17.5p
- F-16 Ventral Fins – 6092/SiC/17.5p rolled P/M
- Fan Exit Guide Vanes – 6092/SiC/17.5p rolled P/M
- Eurocopter Blade Sleeves - 2009/SiC/15p-T4 P/M to replace Ti-6Al-4V-22 Hydraulic Manifold – A206/SiC/40p pressure infiltration (cheaper than whisker-reinforced)
- Ti-MMC Exhaust Valves / Toyota Altezza : Ti-SiC
- MMC Cylinder Liners / Honda Prelude Al-SiC-C
- MMC Brake Rotors or Brake Drums Al-SiC
- MMC Driveshaft / Chevy Corvette
- In Situ MMC / ISPRAM – Extruded Seat Fastening Rail of Airbus
- Forged Connecting Rod Al-SiC
- Recreational products -golf, bicycles, athletic shoes Al-SiC
- DRA Brake Fin for Walt Disney World Big Thunder Railway Thrill Ride Al-SiC
- Generator Housing – Al and Mg reinforced with hybrid-composite- 6092/SiC/17.5p DRA
- MMC electronic cooling plate- Toyota Hybrid Al-SiC
- Al-SiC Microwave packaging used in LEO communication satellites

## Uses of Metal Matrix Composites in Different Sectors, Inspired by the Professor's Research

	COMPONENT	SYSTEM
<b>SPACE</b>	Antenna Waveguide Mast Microwave Thermal Packaging Power Semiconductor Base	Hubble Space Telescope Commercial LEO satellites Commercial GEO comsats
<b>AUTOMOTIVE</b>	Driveshaft Exhaust Valves Engine Block Cylinder Liner Brake Rotor	Chevy Corvette, Pickup Toyota Altezza (Asian market) Honda Prelude Plymouth Prowler
<b>AERO-PROPULSION</b>	Fan Exit Guide Vane	Pratt & Whitney 4XXX engines
<b>AERO-STRUCTURES</b>	Ventral Fin Fuel Access Door Covers Rotor Blade Sleeve	F-16 F-16 Eurocopter EC-120, N-4
<b>THERMAL MANAGEM'T</b>	Power Semiconductor	Motorola Power Chip
<b>RECREATION</b>	Bicycle Frame Brake Fins	Specialized Stump-Jumper Disney Thunder Mtn Thrill Ride

## **Composites Synthesized by Rohatgi and Coworkers Using the Solidification Processing Technique**

- Al-Graphite, Al<sub>2</sub>O<sub>3</sub> (Inco 1965)
- Al-Graphite Fiber
- Al-SiC Particle (Inco 1966)
- Al-Alumina Particle (Inco 1967)
- Al- Zircon (ZrSiO<sub>4</sub>)
- Al- Titania (TiO<sub>2</sub>)
- Al- Zirconia (ZrO<sub>2</sub>)
- Al- Coconut Shell Char
- Al- Illite Clay
- Al- Rice Husk Ash
- Al-Fly Ash
- Al-Red Mud
- Al-SiO<sub>2</sub>
- Iron-Al<sub>2</sub>O<sub>3</sub>
- Iron-Titanium Carbide
- Lead- Graphite
- Lead- Fly Ash
- Al-Graphite-Silicon Carbide
- Al-Graphite-Alumina
- Al-Alumina (47nm)
- Al-Steel Wire
- Copper-Graphite Particle
- Copper-Fly Ash
- Zinc-Graphite
- Zinc-Fly Ash
- Zinc- Alumina
- Magnesium-Graphite
- Magnesium-Fly Ash
- Al-WC

### **Listings in Who's Who**

1. Who's Who in Inventors of America
2. Outstanding Intellectuals of 20<sup>th</sup> century
3. Who's Who in American Science
4. Who's Who of Contemporary Achievement
5. Strathmore Who's Who directory
6. Who's Who of Asian Americans
7. Who's Who in the Sciences

### **Consulting Experience**

Considerable consulting experience with several leading manufacturing organizations with international development agencies in various countries and including but not limited to, UNIDO, UNEP, UNESCO, U.N. Office of Science and Technology, United Nations University (Tokyo, Japan) and World Bank. Helped corporations develop new products, especially from metal matrix composites, solved manufacturing problems, developed research center and proposals and projects, established research departments in industries, and make recommendations on Materials Policy and Research. Prepared several reports on technology policy, materials and educational policy.

### **Patents and Products**

Seventeen U.S. Patents granted and two pending, five Canadian and European Patents, six Indian Patents and two pending, and developed several new products.

### **Honors and Awards**

Banaras University Gold Medals for Outstanding Performance (1961)  
Award for best work in light metals from American Foundrymen's Society (1969)  
National Metallurgists' Day Award from the Ministry, India (1976)  
Indranil Award from Mining and Metallurgical Society of India (1978)  
Gold Medal Award for Technology for the Future from Indian Research Centre (1981)  
Elected to Fellowship Institution of Engineers, India (1981)  
Binani Gold Medal from Indian Institute of Metals for best paper (1982)

Distinguished Alumnus Award from Banaras Hindu University (1983)  
 Elected to Fellowship of Indian Institute of Ceramics (1983)  
 Elected to the Fellowship of American Society for Metals (1984)  
 Distinguished Engineer Award from Association of Engineers from India (1984)  
 Elected to Fellowship of Institute of Metals, London (1985)  
 Received National Research and Development Corporation Award (1986)  
 World Intellectual Property Organization Award (1986)  
 VHP Award for Excellence (1987)  
 Outstanding Research Award from College of Engineering and Applied Science, UWM (1988)  
 Awarded the Samuel C. Weaver Professorship in Materials Engineering (1988)  
 Elected to the Fellowship of American Association of Arts and Sciences (1989)  
 Elected to the Corresponding Fellowship of Third World Academy of Sciences (1990)  
 Appointed to the Joint Commission of Metallurgical Transactions (1990)  
 Awarded the Ford/Briggs and Stratton Professorship (1991)  
 Received the UWM Foundation Outstanding Research Award (1991)  
 Received CEAS–UWM Outstanding Service Award (1992)  
 Elected to the Fellowship of Third World Academy of Sciences (1993)  
 Appointed Foundry Education Foundation Key Professor at UWM (1994)  
 Selected as ASM-IIM Lecturer (1994)  
 UWM Foundation Distinguished Service Award for Distinguished Public Service (1995)  
 Wisconsin Distinguished Professorship (1996)  
 Listed in 11000 Year Timeline of Metal Casting by the American Foundry Society (1996)  
 M. Schiel Award for Excellence in Metallography, First Prize, ASM, Milwaukee Chapter (2000, 2001, 2007)  
 Hall Heroult Scientific Merit Award by American Foundrymen's Society (2000)  
 Silver Anniversary Lecture for Aluminum Division, American Foundrymen's Society (2001)  
 Visiting Lecture Series for Milwaukee School of Engineering (2001)  
 M. Schiel Award for Excellence in Metallography, Third Prize, ASM, Milwaukee Chapter (2002, 2003, 2004, 2008)  
 Microscopic Society of America Award for Physical Sciences to co-authored paper (2002).  
 Silver Jubilee Lecture, Regional Research Laboratory (CSIR), Trivandrum, Kerala (2003).  
 NRI Institute Award of Excellence (2004)  
 Rohatgi Honorary Symposium on Metal Matrix Composites organized by TMS (held March 2006), with proceedings  
 Honorary Medal from Motor Transport Institute, Warsaw, Poland (2006)  
 Bharat Gaurav Award (2007)  
 Elected to Fellowship of American Society of Mechanical Engineers (2007)  
 University of Wisconsin-Milwaukee, Distinguished Professor (2007)  
 College of Engineering and Applied Science, UWM: Award for Highest External Research Grant Dollars and Millionaire Research Grant Club membership (2008)  
 Selected for Hind Rattan Award (Jan 2009)  
 Among Ten Highest Funded Researchers Award, CEAS (2009)  
 ASME Innovative Research Award in Tribology (2010)  
 Elected to Fellowship of Society of Automotive Engineers (2010)  
 American Foundry Society and Foundry Education Foundation, Distinguished Professor Award (2010)  
 Received the Engineers and Scientists of Milwaukee Engineer of the Year Award (2011)  
 Elected to Fellowship of the Society of Manufacturing Engineers (SME) (2011)  
 Elected to Fellowship of the Minerals Materials and Metals Society (TMS) (2011)  
 Received the Minmet Awards Committee award of Lifetime Achievement (2011)

### **Books Authored and Edited**

1. Principal Author of a textbook on *Technology Forecasting*. Tata-McGraw Hill, 1979 (Reprinted)
2. Principal Author and Co-editor, 'Materials Science and Technology in the Future of India', published by Regional Research Laboratory (Trivandrum), INSDOC, CSIR (India), 1980.
3. Principal Author and Co-editor, 'Materials Science and Technology in the Future of Kerala', published by Regional Research Laboratory (Trivandrum), INSDOC, CSIR (India), 1980. (Focus was on the regional imperatives in the state of Kerala)
4. Principal Author and Co-editor, 'Materials Science and Technology in the Future of Madhya Pradesh (India)', published by Regional Research Laboratory (Bhopal), INSDOC, CSIR (India), 1980. (Focus was on the regional imperatives in the state of M.P)
5. Principal Author and Co-editor of *Tribology of Composite Materials*, ASM International, 1990.
6. Principal Author and Editor, *Solidification of Metal Matrix Composites*, TMS, 1990.
7. Principal Author and Editor, *Microstructure Formation during Solidification of Metal Matrix Composites*, TMS 1993.
8. Co-author of book, *Natural Fiber Composites*, Periodical Experts Book Agency, 1994.
9. Principal Author and Co-editor, *Friction, Wear and Lubrication of Metal Matrix Composites*, ASM International 1994.
10. Principal Author and Editor, *Processing, Properties and Applications of Cast Metal Matrix Composites*, ASM International 1997.
11. Principal Author and Editor, "State of the art in Cast Metal matrix Composites", published by TMS, Oct., 2000.
12. M. Nosonovsky and P. K. Rohatgi, *Biomimetics in Material Science: Self-healing, Self-lubricating and Self-Cleaning materials*. Springer Series in Materials Science, Springer, Heidelberg, ISBN-13 – 978-1461409250. Published December 6, 2011.

### **Books and Proceedings in Progress**

Casting of Metal Matrix Composites, Principles of Solidification of Metal Matrix Composites, Metal Matrix – Fly Ash Composites.

### **Authorship of Research Papers**

280 research papers published in materials science and engineering in refereed research publications, including Metallurgical Transactions, Materials Science and Engineering, Journal of Materials Science, Scripta Metallurgica, Composites, SAE, Fiber Science, Tribology International, Transactions of American Foundrymen's Society, Acoustics Letters, Acta Materiala (List A).

Additional 170 research papers in Materials Science and Engineering in Proceedings, many of which were refereed (List B).

An additional 70 papers have been written in technology forecasting, materials policy and educational policy in journals and proceedings. These relate to research in quantitative policy studies on technology and education in the future (List C).

### **Presentation and Invited Papers**

Made several hundred presentations to professional societies, Wisconsin Area Research Managers Meeting, Milwaukee Chamber of Commerce, and the Great Lakes Composites Consortium. Invited to make presentations in the U.S., India, Russia, Europe, Japan, Australia, Mexico, Singapore, China, Jordan and Egypt in 1991-2009. Invited to present papers in NATO Conference, 1998.

### **Editorial and Reviewing Experience**

Served on the Board of International Editors, International Cast Metals Research Journal of American Foundrymen's Society (72-76), Technology Forecasting and Social Change (U.S.A.) (80-86), Transactions, Indian Institute of Metals (79-84), High Temperature Materials (83-88), Metallurgical Transactions (USA) (87-94), Materials for Energy (USA) (86-89), Advanced Materials and Processes (USA) (88-94), Composite Materials Science (U.K.) (86-88), Materials Conservation and Recycling (U.K.) (88-90), Journal of Materials Shaping Technology (USA) (88-92), Journal of Scientific and Industrial Research (India) (81-86), Journal of Materials Engineering and Performance (USA) (93-95), Aluminum Transactions (98- ). Journal of Materials Processing Technology (99 - ), International Cast Metals research Journal (AFS) (2009-). Serves on the Scientific Committee of Transactions of the Foundry Research Institute. (Poland). Reviewed proposals for NSF, National Academy of Science, Wisconsin Solid Waste Program, U.S. Civilian Research and Development Fund, Served on NSF review panels on Composites, Materials, Nanomanufacturing (2006-). Editorial Board of the Transactions of Foundry Research Institute, Poland (2008-), Editorial Board of SRX Materials Science (2010-).

### **Fellowships and Memberships In Professional Societies**

**Fellow of:** Institution of Engineers (India); Institute of Ceramics (India), American Society of Metals; Institute of Materials, Minerals and Mining (London), American Association for Advancement of Arts and Sciences, Third World Academy of Science (Italy); American Society of Mechanical Engineers, Society of Automotive Engineers (USA), Society of Manufacturing Engineers (SME), The Materials and Metals Society (TMS), Society of Automotive Engineers.

**Member of:** Materials Research Society, ASM International, American Foundrymen's Society, American Composites Society, AIAA, , Steering Committee: Institute of High Technology and Materials, Trieste, American Society of Mechanical Engineers, Registered Professional Engineer in the State of Wisconsin (No28698-006), World Futures Society (Milwaukee Chapter).

### **Committee Work in Professional and Government Organizations**

Served on the Advanced Technology Awareness Council, Solidification Committee and Composites, Committee of ASM and AIME, Putnam Award Committee ASM  
Served on Councils of I.I.M and Universities at Trivandrum and Bhopal  
Served on Board of Directors of M.P. Energy Corporation, and Moulana Azad College of Technology; National Committee on Science and Technology, Long Range Planning, and Futures Research Panels of Government of India  
Steering Committee World Future Society, Milwaukee Chapter  
Technical Advisory Board of PTSM  
Advisor, Cooperative Automotive Research Group(CAR),Government of India Coal Advisory Group, Department of Energy, U.S.  
Steering Committee Nanotechnology and Memos Technical Group, Society of Manufacturing Engineers Education Committee American Foundry Society, Wisconsin Chapter (2006-)  
International Advisory Committee, International Conference on Advanced Materials and Composites, Thiruvananthapuram, India, 2007.  
Scientific Committee Cast Composites Conference, Poland 2009  
Scientific Committee, Transactions of the Foundry Research Institute, Krakow, Poland 2009.  
Organizing Committee, International Conference on Advanced Functional Materials 73rd Annual Session of the Indian Ceramic Society, Trivandrum, India, December 9-12, 2009.  
Organizing Committee Member (Biomaterials) First TMS-ABM International Materials Conference, Rio de Janeiro, Brazil, July 26-30, 2010

### **Committee Work in the UW System**

1. Awards and Recognition Committee, CEAS (1990-1994)
2. Chair, Graduate Program Subcommittee since Sept, 1999-2004, Member since 1995 (CEAS)
3. Executive Committee, Materials Department (since 1985)
4. Executive Committee, Industrial and Manufacturing Engineering (1987-1989)
5. TQM Research and Scholarship Subcommittee, CEAS (1995)
6. Advisory Committee, Advanced Analytical Facility, UWM (1995-2000)
7. UW System Solid Waste Research Council, Madison (1998-2004)
8. Task Force on Jobs in Greater Milwaukee Foundry Industry, UWM Center for Economic Development (2000)
9. Chair, Research Committee; CEAS (1998)
10. UWM representative on Wisconsin Space Grant Consortium (1999 - 2003)
11. Action Team Member of Technology Center Program, Milwaukee Idea (1999 - 2003)
12. CEAS alumni Association – Materials Department Representative (1999-2005)
13. UWM Faculty Forum on International Studies and Programs (1999-2003)
14. Member, “Center for Peace Studies,” (1999 - 2000)
15. CEAS Engineering Management Oversight Committee (2002 - 2004)
16. CEAS Growth Plan Implementation Commission (2002 - 2004)
17. CEAS Strategic Planning Committee (2004 - 2008)
18. Academic Planning Committee on Bachelors of Arts in Global Studies, Center for International Education (2005 - 2008)
19. CEAS Committee on Advanced Analytical Facility (2007 - 2008)
20. CEAS Committee on New Engineering Campus (2007- 2008)
21. CEAS Committee on Biomedical Engineering (2010 - present)
22. CEAS Committee on Promotions to Full Professor (2010 – Present)
23. CEAS Committee on Endowed Professor Recruitment (2011 – Present)

### **Selected Institutional and Industrial Contacts in Wisconsin**

Briggs and Stratton, Harley Davidson, Badger Meter, Wisconsin Electric, Eck Industries, AO Smith Corp., Oshkosh Trucks, Amalga, Mechanical industries, Waupaca Industries, Falk Corp., Mercury Marine, Grede Foundries, Wisconsin Area Research Managers, Metropolitan Milwaukee Chamber of Commerce, American Foundrymen’s Society (Wisconsin Chapter), Energy Center Wisconsin Medical College (Milwaukee), Marquette University, MATC, University of Wisconsin (Madison).

Steering Committee Member: Milwaukee Ethnic Council.

Board Member: Wisconsin Coalition of Asian-Indian Organization, Milwaukee Ethnic Council (2006-2008).

### **Major Research Contributions Widely Cited in Textbooks and Journals in Materials**

Theoretical Models and Experimental Work on Dendritic Solidification

Solidification of Metal Matrix Composites during Casting

Structure Property Relationships in Composites

Polymer Natural Fiber Composites

Materials Policy, Education Policy, Technology Policy

Invited chapters have been included in Handbooks, and International Materials Reviews.



### **Student Service**

Provided opportunity for undergraduate and high school students and high school teachers to participate in research in UWM Composites Center, including some under National Institutes of Health and National Center for Research Resources Program, and National Science Foundation Program. Participated in Student Multicultural Activities, including service as Advisor to Students of India and helped organize Students of India Day at UWM (1991-99). Served as Foundry Education Foundation Key Professor. Arranged Foundry Education Foundation Scholarships for several UWM students, in addition to teaching courses and serving as thesis advisor to several students. Faculty advisor to American Foundrymen Society Student Chapter at UWM. Mentored students to win First Research Poster Competition at CEAS, UWM (2009).

### **Research Grants and Programs**

Extramural funding of over \$10.0 million dollars, and equipment donations of over \$500,000 have been received from industry. Research grants, gifts and contracts were from Tank and Automotive Command, Army Research Laboratory, Ford, General Motors, Briggs and Stratton, Electric Power Research Institute, Sundstrand Corporation, Control Data, International Copper Association, Aluminum Company of Canada, Norsk Hydro (Norway), Third Millennium, Commonwealth Aluminum Company (Australia), Oilless (Japan), Office of Naval Research, Department of Energy, Department of Commerce, NSF, Tank and Automotive Command, Army Research Laboratory, Amalga Composites, A. O. Smith, NS Power Co., PSI Energy, Oshkosh Trucks, Thompson Aluminum, Precision Thin Metals, Argotech, CINErgy, ARGOTECH, Wisconsin State Development Grant, DIN Grant from UW System, Wisconsin Applied Research Grant, and Wisconsin Distinguished Professor Grant. PI on TACOM and ARL Projects “Lightweight Materials for Military Transport Applications” funded for \$4 million Participated in writing the research proposal for Great Lakes Composites Consortium, Kenosha, Wisconsin, funded by the Navy.

PI for (a) NSF ERC proposal on Manufacturing of Composites from UWM (b) NSF pre-proposal on “Low Cost Manufacture of Advanced Materials” (\$15 M) and (c) NSF MRSEC proposal on “Advanced Materials” (\$13 M); (these involved participation of several departments and schools at UWM, and other institutions in Milwaukee and out of state institutions; not funded). Co PI with IITRI on Army Mantech Program on Power Transfer Systems. (\$25M for five years); NSF-NER grant on Nanocomposites, participated as thrust leader in 2007 ERC proposal from UWM, PI for 2007 MRSEC proposal from UWM.

As Director in CSIR, administered grants equivalent to two million dollars per year. Organized International Collaborative Research and Student Exchange Programs between (a) UWM and two institutions in Poland through DOC and (b) UWM and four institutions in India.

### **Recent Grants**

- Army Research Lab (ARL) Cooperative Agreement, **\$219,016**
  - Focused on Synthesis and processing of 3D Weave Metal Matrix Composites
- Tank and Automotive Command (TACOM) Grant 1, **\$820,000**
  - Rapid Mobile Manufacture of Lightweight Materials
- Tank and Automotive Command (TACOM) Grant 2, **\$3,474,250 (2009-2012)**
  - Work on Self-Healing and Smart Metals
- NSF US-Egypt Collaborative Grant 1, **\$39,818**
  - Manufacture of Aluminum and Magnesium Composites (2002-2010)
- NSF US-Egypt Collaborative Grant 2, **\$30,000 (2007-2011)**

- Processing of Lead-Flyash Composites for Battery Applications
- Rockwell Automation Catalyst Grant, **\$54,979 (2009-2011)**
  - Processing of Self-Healing Solder
- Southwestern Wisconsin Energy Research and Technology Consortium (2009-2010)
  - Processing of Nanocomposites for Thermoelectricity (**\$5000** for Composites Center)
- RGI:
  - Project: “Simulating the Making of Dual-Scale Metal-Matrix Composites using the Pressure Infiltration Process,” **\$103,567 (2008-2010)**, PI K. Pillai, Co PI Rohatgi.
  - Project: “Demonstration of Feasibility of Self Healing Metal Matrix Micro and Nanocomposites.” PI Rohatgi, CO-PI R. Amano, **\$157,000**
- Catalyst Grant:
  - "Processing of Self-healing solders for automation industry," 2010, **\$54,979**, PI Rohatgi, Co PI Amano
- Bradley Foundation Project:
  - “Simulating the making of dual scale metal matrix composites using pressure infiltration process, PI Krishna Pillai, CO-PI P.K. Rohatgi. **\$59,999**
- NSF ICUCRC Water Industry Center Proposal-Funded July 2010
  - “Project on Self-Cleaning Materials,” PI. P.K.Rohatgi and Co PI. M. Nosonovsky, part of UWM - **\$47,863**
- Army Research Laboratory
  - “Manufacture of bulk nanostructure materials and composites.” PI.P Rohatgi, Contact PI M. Lovell **\$1 million (2010-2012)**.
- GE Healthcare
  - “Materials for Diagnostic Healthcare Equipment.” **\$45,000**

### **Administrative and Organizational Experience**

Served as Chief Executive Office and Founder Director of two research laboratories of Council of Scientific and Industrial Research. These were research and advanced training institutions with large contingents of scientific and administrative staff, carried out all functions of recruiting, budget control and personnel management. Planning and organization of these two institutions from their conception. Organized and administered Technology Forecasting and Management Center at the Indian Institute of Science. Organized laboratories for foundry, solidification, and tribology and UWM Center for Composites at the University of Wisconsin–Milwaukee and served as their Founder Director. Organized and served as chairman of several technical sessions, such as ASM and AIME conferences, including two sessions at the World's Materials Congress, 1988. Organized the first conference on "Solidification of Metal Matrix Composites," in 1989 for AIME-ASM and "Tribology of Composites," for ASM in 1990. Invited to serve on the steering committee of International Institute of High Technology and Materials, Trieste, Italy, and to direct and organize their first composites workshop, by Dr. Abdus Salam, Nobel Laureate. Organized and chaired sessions on "Tribology of Composites" and "Solidification of Composites," during Materials Week, Chicago, 1992, and Materials Week, Pittsburgh, 1993, and Materials Week, Chicago, 1994. "International Conference on Cast Composites," October 18-20, Zakopane, Poland. Organized "Cast Metal Matrix Composites" sessions for materials week, 1996. Served on Councils and Boards of Kerala University, Bhopal University, M.P. Energy Corporation. Organized “State of the Art in Cast Metal Matrix Composites,” Conference for ASM and TMS in the year 2000.

### Volunteer Work in Community

1. Steering Committee Member: Milwaukee Ethnic Council (2002-2007).
2. Board Member: Wisconsin Coalition of Asian Indian Organizations (2002- ).
3. Founding Member: Hindu Temple, Wisconsin (2002-).
4. Several talks on National Public Radio USA and All India Radio (Trivandrum and Bhopal) on materials technology, international issues, and environmental issues.

<b>Classes Taught by Professor Rohatgi at UWM 1985-2011</b>	
<b>Class Number</b>	<b>Class Name</b>
Materials Engineering – 150	Intro To Materials
Materials Engineering – 201	Engineering Materials
Materials Engineering – 380	Engineering Design
Materials Engineering – 421	Metal Casting Engineering
Materials Engineering – 451	Ceramics and Polymeric Materials
Materials Engineering – 455	Engineering Composites
Materials Engineering – 465	Friction and Wear
Materials Engineering – 690	Nanomaterials and Nanomanufacturing
Materials Engineering – 699	Independent Study (Biomaterials)
Materials Engineering – 732	Solidification Processing

\*Between 1968 and 1986 additional forty students received their master's and doctorate degrees under supervision of Rohatgi. In addition he directed a large number of employees including scientists with bachelor's, master's and Doctorate degrees in Materials Science and Engineering.

### **U.S. Patents (1-18) Granted and Filed**

1. "Process for Producing at Least one Constituent Dispersed in a Metal," U.S. Patent 3,600,163, filed Oct. 7, 1966 (cited in 22 later patents), granted to F. A. Badia and Pradeep K. Rohatgi, August 17, 1971.
2. "Method of Making Synthetic Resin Composites with Magnetic Fillers," U.S. Patent 3,867,299, filed 8-11-71, cited in 15 later patents, granted to Pradeep K. Rohatgi, February 18, 1975.
3. "Mold Modifications for Eliminating Freckle Defects in Roll Castings," U.S. Patent 3,882,942, filed 05-24-73, granted to Pradeep K. Rohatgi and L. R. Woodyatt on May 13, 1975.
4. "Composite Metal Bodies," U.S. Patent No. 3,885,959 filed May 10, 1971, granted to F. A. Badia and Pradeep K. Rohatgi on May 27, 1975.
5. "Method for Separating and Recovering Kish Graphite from Mixtures of Kish Graphite and Fume," U.S. Patent 4643349 granted to P. K. Rohatgi, Jan 13, 1976.
6. "Process for the Manufacture of Aluminum-Graphite Composite for Automobile and Engineering Applications," U.S. Patent No. 4,946,647 filed May 4, 1988, granted to Pradeep K. Rohatgi, et al. on August 7, 1990.
7. "Copper Graphite Composite," U.S. Patent 5,200,003 filed 12/28/90, granted to Pradeep K. Rohatgi on April 6, 1993.
8. "Synthesis of Metal Matrix Composites Containing Fly Ash, Graphite, Glass, Ceramics or other Metals," U.S. Patent No. 5,228,494 filed May 1, 1992, granted to Pradeep K. Rohatgi, July 20, 1993.
9. "Thermal Management of Fibers and Particles in Composites," U.S. Patent 5,407,495, granted to Pradeep K. Rohatgi on April 18, 1995.
10. "Nonferrous Cast Metal Matrix Composite," U.S. Patent No. 5,803,153 filed on May 19, 1994, and granted to Pradeep K. Rohatgi on August 8, 1998.
11. "Process for Casting a Light Weight Iron Based Material," U.S. Patent No. 5,765,624 granted to R. Hathaway and Pradeep K. Rohatgi on June 16, 1998.
12. "Methods of Producing Metal Matrix Composites Containing Fly Ash," U.S. Patent No. 5,711,362 filed on November 29, 1995, granted to Pradeep K. Rohatgi, Jan 27, 1998.
13. "Cast Aluminum Metal Matrix Composites," U.S. Patent No. 6,183,877 B-1 filed on August 20, 1997 and granted to J. E. Bell, P. K. Rohatgi, T. F. Stephenson and A.E.M. Warner on February 6, 2001.
14. "Metal Fly Ash Composites and Low Pressure Infiltration Methods for Making the Same," U.S. Patent No. 5,899,256 filed October 3, 1997 and granted to Pradeep K. Rohatgi on May 4, 1999. (Also Patented in EPO, France, Germany, Italy, Spain, U.K.)

15. "Metal Matrix Composite Including Homogeneously Distributed Fly Ash, Binder and Metal," U.S. Patent No. 5,897,943 filed January 3, 1997 and granted to Pradeep K. Rohatgi on April 27, 1999.
16. "Method of Making an Aluminum Base Metal Matrix Composite," U.S. Patent No. 5,626,692 application filed on March 1, 1994 and granted on May 6, 1997 to P. K. Rohatgi, J. E. Bell and T. Stephenson.
17. "Separation of Cenospheres from Flyash," U.S. Patent 8074804B-2 granted Dec 13, 2011 to B. Ramme, J. Noegel, and P. Rohatgi.
18. "Self Healing Structural Alloys - Including Aluminum and Self-Healing Solders," U.S. Patent Application no. 12/537,675 filed on August 7, 2009 by Pradeep K. Rohatgi.

#### **Indian Patents (19-27)**

19. "Preparation of Metal Graphite, Mainly Copper-Graphite Composite by Casting Method," Indian Patent No. 124304 granted to Pradeep K. Rohatgi, A. K. Khare, and P. K. Kelkar, 1972.
20. "Preparation of Aluminum-Alumina Composite," Indian Patent 124305A granted to P. K. Rohatgi, S. Ray, and P. K. Kelkar, 1972.
21. "Aluminum-base metal matrix composite," granted to Pradeep K. Rohatgi, 186823 381/Del/93 April 16, 1993.
22. "A method to produce a metal matrix composite containing reinforcing material," 189673 366/Del/94, granted to Pradeep K. Rohatgi, March 30, 1994.
23. "A process for making casted nonferrous metal matrix composite shapes," 190612, 1367/Del/94, granted to Pradeep K. Rohatgi, October 28, 1994.
24. "A process for making metal matrix composites," Indian Patent No. 0582/DEL/92, granted to P.K.Rohatgi on February 12, 2000.
25. "Synthesis of Metal Matrix Composites", Indian Patent No. 582/Del/92 (Sl. No. 185174) granted to P.K. Rohatgi on November 23, 2000.
26. "An aluminum-base matrix composition and a method for the preparation thereof," Indian Patent No. 381/DEL/93, granted to P.K.Rohatgi on November 17, 2001.
27. "A process for making nonferrous metal matrix composite shapes," Indian patent No. 1367/DEL/94 granted to P.K.Rohatgi on September 8, 2003.

#### **European, Australian and Canadian Patents (28-32)**

28. "Aluminum Base Alloy-Particulate Graphite Composites," Australian Patent 58,777,685 granted to Pradeep K. Rohatgi, et al. on October 3, 1988.
29. "Manufacturing Aluminum Alloy-Graphite Composite," British Patent GB 2194799 granted to P. K. Rohatgi et al. on March 14, 1990.
30. "Aluminum Base Metal Matrix Composite," European Patent 567284 granted to Pradeep K. Rohatgi, on November 10, 1993.
31. "Aluminum Base Metal Matrix Composite", Canadian Patent No. 2,094,369, granted to P.K. Rohatgi, J.A. Bell and T.F. Stephenson on April 19, 2001.
32. "Cast Alumina Metal Matrix Composites", Canadian Patent No. 2,245,189, granted to Bell James Alexander Evert, Rohatgi Pradeep Kumar, Stephenson Thomas Francis, and Warner Anthony Edward Moline on October 14, 2003.

### **Technologies available for Manufacturing Industry**

1. Cast Aluminum-Fly Ash components for transportation and electromechanical machinery, including intake manifolds, mounting brackets, meter casing and transmission housing.
2. Self lubricating Cast Aluminum Graphite particle components for pistons, liners and bearings.
3. Aluminum Matrix Nanocomposites castings for structural and wear resistant applications
4. Cast Aluminum-Graphite fiber composite components for structural and thermal management applications
5. Lead free Copper Graphite components for plumbing and bearing applications
6. Cast iron base composites with enhanced modulus and decreased density for transportation and machinery applications
7. Lead fly ash cenosphere composites for light weight battery applications and x-ray shields
8. Polymer-fly ash cenosphere composites for energy absorbing applications
9. Polymer-natural fiber composites for structural and non-structural applications
10. Self healing stress alloys and composites preliminary