

Annual Report 2001

1.0 Introduction

The Mission of the Department of Materials Science and Engineering is to produce B.S./M.S./PhD. Graduates who can excel in leadership positions in industry and academia at the national and international levels. The specific details of our Strategic Plan for accomplishing this Mission are given in Appendix I of this report. The manner in which we accomplish much of our work is through various Departmental Committees (Appendix II). The committee reports for AY 2000-01 are given in Appendix III. During this reporting year, the department also established an annual Departmental Retreat at which the key strategic goals and objectives are discussed and finalized by the Faculty. During AY 2000-01, the Retreat was held in February 2001.

1.1 Faculty and Staff

- **Surya Kalidindi** (Ph.D., MIT), Department Head and Professor
- **Michel Barsoum** (Ph.D., MIT), Distinguished Professor
- **Roger Doherty** (D.Phil., Oxford, UK), Professor
- **Yury Gogotsi** (Ph.D., Kiev Polytechnic, Ukraine) Professor
- **Frank Ko** (Ph.D., Georgia Tech.), Professor
- **Alan Lawley** (Ph.D., U. Birmingham, UK), A. W. Grosvenor Professor, National Academy of Engineering
- **T. S. Venkataraman** (Ph.D., WPI), Professor
- **Wei-Heng Shih** (Ph.D., Ohio State), Associate Professor
- **Antonios Zavaliangos** (Ph.D., MIT), Associate Professor
- **Michele Marcolongo** (Ph.D., U of Pennsylvania), Assistant Professor
- **Thomas Twardowski** (Ph.D., U of Illinois - Urbana), Assistant Professor
- **Jeffrey Waldman** (Sc.D., MIT), Instructor
- **Maggie Wheatley** , Courtesy Appointment, Professor
- **John DiNardo**, Courtesy Appointment, Professor
- **Yen Wei**, Courtesy Appointment, Professor
- **Giuseppe Palmese**, Courtesy Appointment, Associate Professor

- **Riad H Gobran** (Ph.D.), Research Professor
- **M. El-Sherif** (Ph.D., Drexel), Research Professor
- **Richard Knight** (Ph.D., Loughborough, UK), Research Professor
- **Wan Shih** (Ph.D., Ohio State), Research Associate Professor
- **Tamer El-Raghy** (Ph.D., Drexel), Research Associate Professor
- **Amotz Geshury** (Ph.D., North Carolina State University), Research Assistant Professor
- **Anisur Rahman** (Ph.D., Drexel), Research Assistant Professor
- **Judy Trachtman**, Administrative Assistant to Department Head
- **Marcie Adams**, Secretary
- **David Von Rohr**, Technical Staff
- **Stephanos Karas**, Technical Staff (Part-time)
- **Dustin Doss**, Technical Staff
- **John McKelvie**, Technical Staff
- **Mitch Marmel**, Technical Staff
- **Alexander Sedmak** (Ph.D.), Visiting Professor (University of Belgrade)
- **Suleyman Saritas** (Ph.D.), Visiting Professor (Middle East Technical University)
- **15 Post-Doctoral Fellows** and **Visiting Research Scholars**
- **Roger Corneliussen**, Emeritus Professor
- **Ihab Kamel**, Emeritus Professor
- **Jack Keverian**, Emeritus Professor
- **Harry C. Rogers**, Emeritus Professor
- **Samuel K. Nash**, Emeritus Professor

Surya Kalidindi was promoted to a full professor during the 2000-2001 academic year, and was appointed as the permanent department head in September 2001.

Michel Barsoum , as part of the Humboldt Award that he won, was on Sabbatical leave at

the Max Planck Institute in Stuttgart, Germany, continuing to work on various aspects of the MAX phases; from synthesis of new compounds, to their characterization, and measurement of their thermodynamic and kinetic parameters. In addition, Professor Barsoum gave invited technical presentations at more than a dozen European universities.

The Department recruited **Chris Li** from the Department of Polymer Science of the University of Akron, as an assistant professor, starting in January 2002. Prof. Li will be teaching and conducting research in the area of solid-state physics and chemistry of polymeric materials.

Stephanos Karas was hired for part-time computer support.

2.0 Education Activities

2.1 Teaching Loads

The table below presents a summary of the courses taught, the name of the instructors responsible for the courses, and the credit hours produced for all courses taught by the faculty of the Department of Materials Science and Engineering during the Academic Year 2000-2001.

Fall 2000-01					
Subject Code	Course Number	Credit Hrs	Enrollment	Instructor	Course Title
MATE	100	2.0	95	Waldman	Materials Technology and Man
MATE	101	4.0	14	Lee	Fundamentals of Materials
MATE	216	4.5	17	Twardowski	Polymers I
MATE	240	4.0	18	Shih	Thermo & Kinetics Matls I
MATE	345	4.0	13	Shih	Ceramics II-Proc & Prop
MATE	360	3.5	16	Lawley	Metals I
MATE	370	3.0	18	Kalidindi	Mechanical Properties I
MATE	400	3.0	12	Ko	Materials Engineering Design I
MATE	460	4.0	13	Zavaliangos	Engn. Computational Lab
MATE	491	2.0	12	Ko	Senior Project Design I
MATE	499		1	Doherty	Independent Study
MATE	501	3.0	13	Twardowski	Struct & Props Polymers
MATE	520	3.0	10	Ko	Engn. Props Fibrous Materials
MATE	560	3.0	7	Lawley	Powder Metallurgy I
MATE	580	3.0	2	Zavaliangos	Numerical Methods
MATE	610	3.	10	Kalidindi	Mechanical Behavior of Solids
MATE	699		6	Doherty	Independent Study and Research
MATE	897		10	Doherty	Research
MATE	898		3	Doherty	Master's Thesis
MATE	998		5	Doherty	Ph.D. Dissertation
TDEC	111	3.0	572	Venkataraman	Phys. Fndns. of Engn. I
TDEC	180	3.0	85	Venkataraman	Calculus Practicum for Engn
TDEC	211	3.0	212	Marcolongo	Materials I
TDEC	212	1.5	50	Doherty	Materials II
TDEC	231	0.67	201	Waldman	Eval./Pres. Exptl. Data I
Winter 2000-01					
Subject Code	Course Number	Credit Hrs	Enrollment	Instructor	Course Title
MATE	101	4.0	23	Waldman	Fundamentals of Materials
MATE	130	3.0	17	Waldman	Materials Laboratory I
MATE	245	4.0	16	Shih	Thermo & Kinetics Matl. II
MATE	270	4.0	16	Twardowski	Advanced Materials Laboratory
MATE	315	4.5	19	Zavaliangos	Polymers II - Processing
MATE	340	4.0	22	Gogotsi	Fundamentals of Ceramics
MATE	366	4.5	14	Doherty	Metals II

MATE	410	3.0	12	Lawley	Materials Engr. Design II
MATE	472	3.0	11	Marcolongo	Mechanical Properties II
MATE	492	2.0	12	Ko	Senior Project Design II
MATE	499		2	Kalidindi	Independent Study
MATE	500	3.0	15	Doherty	Struct. & Props. of Metals
MATE	510	3.0	14	Shih	Thermodynamics of Solids
MATE	521	3.0	2	Ko	Mech Planar Fibrous Assem
MATE	540	3.0	10	Twardowski	Polymer Morphology
MATE	699		5	Kalidindi	Independent Study and Research
MATE	897		11	Kalidindi	Research
MATE	898		1	Kalidindi	Master's Thesis
MATE	998		3	Kalidindi	Ph.D. Dissertation
TDEC	113	3.0	385	Venkataraman	Phys. Fndns of Engr. II
TDEC	180	1.0	94	Venkataraman	Practicum for Engr II
TDEC	212	1.5	85	Lawley	Materials II
TDEC	232	0.67	180	Waldman	Eval./Pres. Exptl. Data II

Spring 2000-01

Subject Code	Course Number	Credit Hrs	Enrollment	Instructor	Course Title
MATE	100	2.0	5	Waldman	Materials Technology and Man
MATE	101	4.0	20	Burlingame	Fundamentals of Materials
MATE	440	3.0	7	Deluccia	Degradation of Materials
MATE	493	4.0	11	Ko	Senior Project Design III
MATE	495	3.0	31	Twardowski	Special Topics: Spoken Polymer
MATE	499		3	Kalidindi	Independent Study
MATE	502	3.0	19	Shih	Ceram & Electronic Matls
MATE	525	3.0	7	Ko	Intro Composite Materials
MATE	561	3.0	7	Zavaliangos	Powder Metallurgy II
MATE	580	3.0	5	Twardowski	Special Topics: Spoken Polymer
MATE	699		6	Kalidindi	Independent Study and Research
MATE	897		18	Kalidindi	Research
MATE	898		5	Kalidindi	Master's Thesis
MATE	998		5	Kalidindi	Ph.D. Dissertation
TDEC	115	3.0	340	Venkataraman	Phys. Fndns. of Engr III
TDEC	180	1.0	84	Venkataraman	Practicum for Engr. III
TDEC	211	3.0	284	Doherty	Materials I
TDEC	231	0.67	279	Waldman	Eval./Pres. Exptl. Data I

Summer 2000-01

Subject Code	Course Number	Credit Hrs	Enrollment	Instructor	Course Title
MATE	101	4.0	14	Burlingame	Fundamentals of Materials
MATE	699		1	Kalidindi	Independent Study and Research
MATE	897		16	Kalidindi	Research
MATE	898		5	Kalidindi	Master's Thesis
MATE	998		1	Kalidindi	Ph.D. Dissertation
TDEC	212	1.5	150	Lawley	Materials II
TDEC	212	1.5	125	Lawley	Materials II
TDEC	232	0.67	275	Waldman	Eval./Pres. Exptl. Data II

2.2 Teaching Awards

- **Alan Lawley**, the A. W. Grosvenor Professor of Materials Engineering, will be the recipient of the 2002 Educator Award of the Minerals, Metals and Materials Society (TMS). This award recognizes outstanding contributions to education in metallurgical engineering, and materials science and engineering. Many distinguished professors in the field of materials science and engineering have received this award in the past. Professor Lawley will receive this award at the 2002 TMS Annual Meeting.
- **Wei Shih** was awarded Professor of the Year, College of Engineering, Student Choice Award, 2001.
- **Riad Gobran** received the Walter E. Werber Award for 2000 from the Department of Materials Science and Engineering, Drexel University.
- **Richard Knight** received the "Instructor of Merit" Award, Materials Engineering Institute, ASM International®, Oct. 2000.
- **Ayman Salem**, a graduate student in our department, won the "Teaching Assistant Excellence" Award in the COE for his work on the t-DEC course.

2.3 Student Awards and Honors

- **Elizabeth Hoffman, Dan Penrose and Alex Tsurikov** were each awarded \$1,500 scholarships from the Philadelphia Chapter of ASM International®.
- The scholarship recipients for Materials Engineering students at Drexel Honors Day were:

Kevin J. O'Hara Scholarship:	Beth Carroll
Elmer W. Griscom Scholarship:	Ethan Hackett
Smith Award	Ben Manderachi
Kaplan Award	Linh Ho-Duc
Muchnic Award	Elizabeth Hoffman
Dunlap Award	Brandon McWilliams
Clayton Family Scholarship	Michael Marucci

- **Michael Marucci** – First Place Senior Design Award, Department of Materials Science and Engineering: "Effect of Small Additions of Boron on the Mechanical Properties and Hardenability of Sintered P/M Steels."
- **Jian-Ming Yuan** - The Jayajumar Radhakrishnan Award for Academic Performance, June 9, 2001.

2.4 List of Graduates

Ph.D. Degrees:

Yu-Hsun Nien, "Swellable Bone Anchors: Development and Evaluation.;"
Supervising Professor: Surya Kalidindi

Miladin Radovic, "Effect of Temperature and Microstructure on Tensile and Creep Properties of Ti_3SiC_2 in Air,;"
Supervising Professor: Michel Barsoum

Chia-yi Yang, "Experimental Study and Numerical Simulation on Synthesis, Properties and Applications of Oxide-Coated Ceramic Particles,"
Supervising Professor: Wei-Heng Shih

Jianming Yuan, "Polymer Materials as Modified Optical Fiber Cladding for Chemical Sensors,"
Supervising Professor: Mahmoud El-Sherif

M.S. Degrees:

Jill Bennett
Elizabeth Gentile
Baohua Han
Linh Ho-Duc
Leslie Kohler
Benedict Manderachi
Jaime Ostroha
Kenneth Richards
Anthony Rozanski
Islam Salama
Mei Yin

B.S. Degrees:

Ryan Aulenbach
Jill Bennett
Jack Chiang
Jason DeCaestecker
Delia Garcia
Elizabeth Gentile
Kate Gomes
Irene Gonzalez
Linh Ho-Duc
Joshua Houskamp
Benedict Manderachi
Shane Marlin
Michael Marucci
Jamie Ostroha
Scott Quillan
Jumatatu Reed
Kenneth Richards
Kyle Robinson
Theresa Shetter

3.0 Research Activities

3.1 New Research Grants

During the fiscal year ending June 30th, 2001 the Department of Materials Science and Engineering submitted 58 proposals valued at \$43,828,433 and had 53 total active grants with a project-to-date budget of \$7,904,202. During the fiscal year ending June 30, 2001,

the Department received 41 new awards valued at \$2,856,005.

During the fiscal year ending June 30, 2001 the department received \$131,727 in Gifts.

Also, Michel Barsoum and Tamer El-Raghy successfully negotiated an exclusive Licensing Agreement between Drexel University and Kanthal Corporation, which included a \$200,000 licensing fee and a royalty stream based on sales of the new powders developed by them.

3.2 Research Awards and Honors

- **Michel Barsoum and Tamer El-Raghy** became Members of the "10⁶ Club" of Drexel University and their research was the featured article and the Cover of the May 2001 issue of American Scientist.
- **Roger Doherty** presented a Keynote Paper entitled "Investigations of Polycrystalline Plasticity for Recrystallization Processing: Experiments and Simulations" at the 21st Riso International Symposium on Materials Science, Roskilde, Denmark, Sept. 2000.
- **Yury Gogotsi** was the winner of the National Collegiate Inventors Competition, 2001 (with S. Welz, D. A. Ersoy and M. J. McNallan) given by the National Inventors Hall of Fame for their work titled "Conversion of Silicon Carbide to Diamond to Produce Dynamic Seals with Superior Properties." Professor Gogotsi received a \$5,000 cash award.
- **Alan Lawley , Roger Doherty and Suleyman Saritas** received the 2001 Outstanding Technical Paper Award of the Metal Powder Industries Federation. Paper title: "Effect of Porosity on the Hardenability of Powder Metallurgy Steels." Selected from approximately 200 technical presentations at the International Conference on Powder Metallurgy and Particulate Materials, New Orleans, LA, May 2001.
- **Ayman Salem**, Surya Kalidindi and Roger Doherty were awarded First place in the 2001 TMS Outstanding Student Paper Contest, Graduate Division, for their paper titled "Strain Hardening of Titanium: Role of Deformation Twinning," which will be presented at the TMS Annual Meeting in Seattle, WA, in February 2002. Ayman Salem was awarded \$750 cash, a certificate and up to \$250 in travel expenses to attend the Feb 2002 TMS meeting in Seattle WA.
- **Daibin Ge, Nina Orlovskaya, Yury Gogotsi and A. Nicholls** won the First Place in Transmission Electron Microscopy, Graduate Category, in the Ceramographic Competition at the Annual American Ceramic Society Meeting in Indianapolis, April 22-25, 2001. Their poster was titled, "Domain Walls in LaCoO₃ Perovskite."
- **Irene Nina Gonzalez, Nina Orlovskaya and Yury Gogotsi** won the Second Place in Undergraduate Category, in the Ceramographic Competition at the Annual American Ceramic Society Meeting in Indianapolis, April 22-25, 2001. Their poster was titled, "Indentation Induced Deformation in LaCoO₃ Perovskite."
- **Irene Nina Gonzalez** received an Undergraduate Materials Research Initiative Fellowship from the Materials Research Society (MRS). She presented the results of her research at the Spring 2001 MRS Meeting and her poster was nominated for Best Poster Award at the meeting.

- **Michael Marucci** won the 2001 Powder Metallurgy Metallography Competition (Student Category) at the International Conference on Powder Metallurgy and Particulate Materials for the entry titled “Boron – Know When to Say When.”
- **Nevin Naguib, Jainming Yuan** (Graduate Students) and **Jill Bennett, Kenneth Richardson, and Jonathan Thomas** (B.S./M.S. students) in the Department of Materials Science and Engineering have each been named a National Collegiate Award Winners in Materials Engineering in 2001, a prestigious honor given by the United States Achievement Academy
- **Jamie Ostroha** was the winner of the Society of Plastics Engineers (SPE), Medical Plastics Division, Student Paper Award for the paper entitled “Polymeric Vascular Graft Design for Endothelialization.” The paper was co-authored by J. Ostroha, J. San Antonio, M. Germann and T. Twardowski and was presented at the SPE Annual Technical Conference, ANTEC 2001, 6-10 May 2001, Dallas, TX.

The following posters from students and faculty of the Department of Materials Science and Engineering received the Best Poster awards from Drexel and MCP Hahnemann Universities Third Annual Research Day, May 1, 2001.

- **Nevin Naguib, Yury Gogotsi and Joseph Libera**, "In-Situ Chemical Experiments in Carbon Nanotubes."
- **Svetlana Dimovski , Yury Gogotsi and Joseph Libera**, "A New Class of Conical Graphite Nanocrystals."
- **Svetlana Dimovski , Richard Knight and Thomas Twardowski**, "Thermal Spraying of Amorphous Matrix Polymer/Silica Nanocomposites."
- **Joshua Houskamp, Thomas Twardowski and Tod Glogovsky**, "In Mold Painting of Polyolefins."
- **Kate Gomes, J. Thomas, A. Lowman and M. Marcolongo**, "Associated Hydrogels for Nucleus Pulposus Replacement."
- **Kyle Robinson, D. S. Katti, M. A. Attawia, F. Ko and C. T. Laurencin** received a special award from the COE for their poster "Development of PLAGA Nanofibers for the Treatment of Wounds."

3.3 Major Publications

3.3.1 Books, Chapters, Editorials

1. "Crystal Plasticity Modeling and Simulations," edited by S. R. Kalidindi, special issue of International Journal of Plasticity, 17(6), (2001).
2. "Textile Structural Composites," F. Ko, X. M. Tao and X. J. Xian, Scientific Publishing Co., Beijing, China, (2000).
3. A. Zavaliangos , A. Laptev, "Recent Developments in Computer Modelling of Powder

Metallurgy Processes." IOS Press, Netherlands ISBN: 1586030949, (2001).

4. I. D. Norris, M. M. Shaker, F. K. Ko, A. G. MacDiarmid, "Electrostatic Fabrication of Ultrafine Conducting Fibers: Polyaniline/Polyethylene Oxide Blends, *Synthetic Metals*," Elsevier, (2000).
5. V. Domnich, Y. Gogotsi, Chapter 5: High Pressure Surface Science, in *Handbook of Surfaces and Interfaces in Materials*, H.S. Nalwa, Ed., Vol. 2, pp. 195-237, Academic Press, (2001).
6. V. Domnich, Y. Gogotsi, High Pressure Surface Science, in *Experimental Methods in the Physical Sciences*, R. J. Celotta & T. Lucatorto, Eds., 38, pp. 355-445, Academic Press, (2001).
7. K. G. Nickel, Y. Gogotsi, Corrosion of Hard Materials, in *Handbook of Ceramic Hard Materials*, R. Riedel, Ed., 1, pp. 140-182, VCH/Wiley, (2000).
8. K. G. Nickel, T. Kraft, Y. Gogotsi, Hydrothermal Synthesis of Diamond, in *Handbook of Ceramic Hard Materials*, R. Riedel, Ed., Vol. 1: pp. 374-389, VCH/Wiley, (2000).
9. S. Saritas and A. Lawley, "Processing and Properties of Ferrous Powder Metallurgy Materials – A Literature Database," Metal Powder Industries Federation, Princeton, NJ, CD#5036CD, (2001).
10. T. S. Venkataraman, N. J. DiNardo and I. A. Miller, "Undergraduate Physics Laboratory Manual-2000 Edition," John Wiley Publishers, Sept. (2000).
11. T. S. Venkataraman and D. H. Thomas, "Physical Foundations of Engineering-Applications and Resource Book," IV Edition, John Wiley Publishers, Sept. (2000).
12. M. W. Barsoum, "The $M_{N+1}AX_N$ Phases: Thermodynamically Stable Nanolaminates," *Prog. Sol. State Chem.*, 28, pp. 201-281 (2000)

3.3.2 Refereed Journal Publications

1. D. Li, H. Garmestani, S. R. Kalidindi and R. Alamo, "Crystallographic Texture Evolution in High Density Polyethylene During Uniaxial Tension," *Polymer*, 42, pp. 4903-4913, (2001).
2. B. Peeters, M. Seefeldt, C. Teodosiu, S. R. Kalidindi, P. Van Houtte and E. Aernoudt "Work-Hardening/Softening Behaviour Of B.C.C. Polycrystals During Changing Strain Paths: I. An Integrated Model Based on Substructure and Texture Evolution," *Acta Materialia*, 49, pp. 1607-1619, (2001).
3. Y. Nien, S. R. Kalidindi and S. Siegler, "Fixation Strength of Swellable Bone Anchors in Low Density Polyurethane Foam," *The Journal of Biomedical Materials Research - Applied Biomaterials*, 58, pp. 137-146, (2000).
4. G. M. Gualtieri, R. H. Gobran, Y. Nien and S.R. Kalidindi, "Swelling of Crosslinked Poly (Methylmethacrylate-Acrylic Acid) Copolymers in Serum and Saline Solutions," *J. Appl. Polymer Sci.*, 79, pp. 1653-1664, (2001).
5. S. R. Kalidindi and S. E. Schoenfeld, "On the prediction of yield surfaces by the crystal plasticity models for fcc polycrystals," *Materials Science and Engineering*, A293, pp. 120-129, (2000).
6. E. Petrovicova, R. Knight, L. S. Schadler and T. E. Twardowski, "Nylon 11/Silica

- Nanocomposite Coatings Applied by the HVOF Process: Part II. Mechanical and Barrier Properties," *J. of Applied Polymer Science*, 78, No. 13, pp. 2272-2289, (2000).
7. N. Orlovskaya, N. Gonzalez, "Nonelastic Ferroelastic Behavior of LaCoO_3 based Ceramics under Contact Loading," *J. Materials Processing and Manufacturing Science*, 9, 53-63, (2000).
 8. X. Li, J. Vartulli, D. L. Milius, I. A. Aksay, W. Y. Shih and W.-H. Shih, "Electromechanical Properties of a Ceramic d31-Gradient Flextensional Actuator," *J. Am. Ceram. Soc.*, 84 (5), pp. 996, (2001).
 9. W. Y. Shih, X. Li, H. Gu, W.-H. Shih and I. A. Askay, "Simultaneous Liquid Viscosity and Density Determination Using Piezoelectric Unimorph Cantilevers," *J. Appl. Phys.*, 89, pp. 1497, (2001).
 10. C. Y. Yang, W. Y. Shih and W.-H. Shih, "Monte Carlo Simulations of the Nucleation and Growth Process of Colloidal Particles," *Phys. Rev. E.*, 64, 021403, (2001).
 11. C. J. Rawn, M. W. Barsoum, T. El-Raghy, A. Procopio, C. M. Hoffmann and C. Hubbard, "Structure of $\text{Ti}_4\text{AlN}_{3-x}$ - a Layered $\text{M}_{n+1}\text{AX}_n$ Nitride," *Mater. Res. Bull.* 35, pp. 1785-1796 (2000).
 12. M. W. Barsoum, T. El-Raghy and M. Radovic, " Ti_3SiC_2 : A Layered Machinable Ductile Ceramic," *Interceram*, 49, pp. 226-233, (2000).
 13. T. El-Raghy, S. Chakraborty and M. W. Barsoum, "Synthesis and Characterization of Hf_2PbC , Zr_2PbC and M_2SnC ($\text{M} = \text{Ti}, \text{Hf}, \text{Nb}$ or Zr)," *J. Europ. Cer. Soc.*, 20, pp. 2619-2625, (2000).
 14. M. Y. Gamarnik, M. W. Barsoum and T. El-Raghy, "Improved X-ray Powder Diffraction Data for Ti_2AlN ," *Powder Diffraction*, 15, pp. 241-242, (2000).
 15. T. El-Raghy, M. W. Barsoum and M. Sika, "Reaction of Al with Ti_3SiC_2 in the 800–1000 °C Temperature Range", *Mater Sci. Eng. A*, 298, 174-178 (2001).
 16. M. W. Barsoum, H.-I. Yoo, I. K. Polushina, V. Yu. Rud', Yu. V. Rud' and T. El-Raghy, "Electrical Conductivity, Thermopower and Hall Effect of Ti_3AlC_2 , Ti_4AlN_3 and Ti_3SiC_2 ," *Phys. Rev. B*, 52, pp. 10194-10199, (2000).
 17. M. W. Barsoum, T. El-Raghy, W. D. Porter, H. Wang, J. C. Ho and S. Chakraborty, "Thermal Properties of Nb_2SnC ," *J. Appl. Phys.*, 88, pp. 6316, (2000).
 18. S. Myhra, J. A. A. Crossley and M. W. Barsoum, "Crystal-chemistry of the Ti_3AlC_2 and Ti_4AlN_3 Layered Carbide/Nitride Phases-Characterization by XPS," *J. Phys. and Chem. Solids*, 62, pp. 811-817, (2001).
 19. M. W. Barsoum, "Oxidation of $\text{Ti}_{N+1}\text{AlX}_N$ where $n= 1-3$ and X is C, N, Part I: Model," *J. Electrochem. Soc.* 148 (84), pp. C544-C550, (2001).

20. M. W. Barsoum, N. Tzenov, A. Procopio, T. El-Raghy and M. Ali, "Oxidation of $TiAlX_n$ where $n = 1-3$ and X is C, N, Experimental Results," *ibid.* pp. C551-C562.
21. M. W. Barsoum and T. El-Raghy, "The MAX Phases: Unique New Carbide and Nitride Materials," *American Scientist*, 89, pp. 336-345, (2001).
22. M. W. Barsoum, M. Radovic, P. Finkel and T. El-Raghy, " Ti_3SiC_2 and Ice," *Appl. Phys. Letters*, 79, pp. 479-481, (2001).
23. A. Rahman, J. G. Bakuckas, Jr, C. A. Bigelow and P. W. Tan, "Boundary Correction Factors for Elliptical Surface Cracks Emanating from Countersunk Rivet Holes," *AIAA Journal*, 38, (11), pp. 2171-2175, (2000).
24. Zavaliangos, A. and Bouvard, D., "Numerical Simulation of Anisotropy in Sintering Due to Prior Compaction," *International Journal of Powder Metallurgy (USA)*, 36 (7), pp. 58-65, Oct. (2000).
25. Zavaliangos, A. and Bouvard, D., "Anisotropy in sintering", *International Journal of Powder Metallurgy (USA)*, 37 (4), pp. 5-7, May (2001).
26. Tzimas, E. and Zavaliangos, A., "An Evaluation of Volume Fraction of Solid in Alloys Formed by Semisolid Processing," *Journal of Materials Science (USA)*, 35 (21), pp. 5319-5329, 1 Nov. (2000).
27. Y. Gogotsi, J. A. Libera, A. Güvenç-Yazicioglu and C. M. Megaridis, "*In-situ* Multi-Phase Fluid Experiments in Hydrothermal Carbon Nanotubes," *Appl. Phys. Lett.*, 79 (7), pp. 1021-1023, (2001).
28. B. Basavalingu, J. M. Calderon-Moreno, K. Byrappa, Y. G. Gogotsi and M. Yoshimura, "Decomposition of Silicon Carbide in the Presence of Organic Compounds Under Hydrothermal Conditions," *Carbon*, 39, pp. 1763-1767, (2001).
29. J.A. Libera and Y. Gogotsi, "Hydrothermal Synthesis of Graphite Tubes Using Ni Catalyst," *Carbon*, 39 (9), pp. 1307-1318, (2001),
30. Y. Gogotsi, S. Welz, D.A. Ersoy and M. J. McNallan, "Conversion of Silicon Carbide to Crystalline Diamond-Structured Carbon at Ambient Pressure," *Nature*, 411, pp. 283-287, (2001).
31. Y. Gogotsi, G. Zhou, S.-S. Ku and S. Cetinkunt, "Raman Microspectroscopy Analysis of Pressure-Induced Metallization in Scratching of Silicon," *Semicond. Sci. Technol.*, 16 (5) pp. 345-352, (2001).
32. Y. Gogotsi, "Perspective: Designing Carbon Crystals for Nanotechnology Applications," *Crystal Growth and Design*, 1 (3), 179-181, (2001) (Invited).
33. B. A. Galanov, S. M. Ivanov, E. V. Kartuzov, V. V. Kartuzov, K. G. Nickel and Y. G. Gogotsi, "Model of Oxide Scale Growth on Si_3N_4 Ceramics: Nitrogen Diffusion Through Oxide Scale and Pore Formation," *Computational Mater. Sci.* 21 (1), pp. 79-85, (2001).
34. Y. Gogotsi, J. A. Libera and M. Yoshimura, "Hydrothermal Synthesis of Multiwall Carbon Nanotubes," *Journal of Materials Research*, 15 (12), pp. 2591-2594, (2000).

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38. M.El-Sherif, K. Fidanboyly, D. El-Sherif, R. Gafsi, J. Yuan, K. Richards and C. Lee, "A Nove FiberOptic System for Measuring the Dynamic Structural Behavior of Parachutes," *J. of Intelligent Material Systems and Structures*, Vol. II, No. 5, pp. 351-359, (2000).
39. Mahmoud A. El-Sherif, Jianming Yuan, and Alan MacDiarmid, "Fiber Optic Sensors and Smart Fabrics," *J. of Intelligent Material Systems and Structures*, Vol. II, No. 5, pp. 407-414, (2000).

3.3.3 Patents Issued

R. Knight and M. W. Barsoum, "Corrosion, Oxidation and/or Wear-Resistant Coatings," U. S. Patent No. 6,231,969 B1, May 15, 2001.

Nine patents were filed during this reporting period.

4.0 Service Activities

4.1 Service to Profession

- **Michel Barsoum** serves as a Member of the Chart Policy Committee of the Phase Equilibria Program of the American Ceramic Society.
- **Roger Doherty** serves as a Member of the International Committee for the International Conference on Recrystallization and Grain Growth.
- **Yury Gogotsi** serves as a Member of the Nominating Committee of the Basic Science Division of the American Ceramic Society, as a Member of the Research Board of Directors of the American Biographical Institute, as a Member of the Editorial Boards of *Journal of Materials Processing and Manufacturing Science*, *Advances in Technology of Materials and Materials Processing Journal (ATM)*, *Reviews in Advanced Materials Science*, *Materials Physics and Mechanics*, and a Proposal Reviewer for National Science Foundation (SBIR panel review and proposals), U.S. Civilian Research and Development Foundation, and Research Grants Council, Hong Kong.
- **Frank Ko** served as a Member of the Organizing committee of the TEXCOMP Conference, served as a Member of the Army Research Office Assessment Team for Global Activities for Low Cost Composite Manufacturing, served as a Member of NAS Board on Army Sciences and Technology Committee on Strategies to Protect the Health of Deployed US Forces,

continues to serve as a Member of the Editorial Boards of the Journal of Composites Technology and Research (JCTR), Composites Manufacturing and Science (CMS), SAMPE Journal and Journal of Nonwovens Research and serves as a Proposal reviewer for National Science Foundation, European Community Research, Hong Kong Industrial Department and Canadian National Research Council.

- **Alan Lawley** was selected to be a Member of the Task Group on Research for the International Space Station, National Research Council/National Academy of Engineering, was Co-Chair of the International Conference on Process Modeling in Powder Metallurgy and Particulate Materials, Metal Powder Industries Federation, was on the Program Committee for PM²TEC 2001, Metal Powder Industries Federation, was a member of the Program Committee: Aluminum and Light Alloys for Automotive Applications Conference, Metal Powder Industries Federation, was Co-Chair of the Advanced Powder Metallurgy Short Course, Metal Powder Industries Federation and was a Judge of the 2001 Powder Metallurgy Metallography Competition, APMI International.
- **Alan Lawley** continues to serve as a Member of the Technical Board, Metal Powder Industries Federation (MPIF), as a Member of the National Academy of Engineering and Liaison with National Research Council and Institute of Medicine for Materials Engineering Division, as a Member of the AIME Hoover Award Committee, as a Member of the Council of Fellows, ASM International®, as a Director of APMI International, as the Editor-in-Chief of the International Journal of Powder Metallurgy, as Chair of the Powder Metallurgy Technologist Certification Commission, APMI International and as a Member of the Editorial Review Committee for Powder Metallurgy Science and Technology Briefs, Metal Powder Industries Federation.
- **Michele Marcolongo** serves as the Organizational Chair, Orthopaedics Special Interest Group of The Society for Biomaterials and as a Reviewer for the SBIR Study Section of the NIH/NIAMS.
- **Thomas Twardowski** served as President and Board Member of the Philadelphia Section of Society for Plastics Engineers.
- **Antonios Zavaliangos** served as Co-organizer of Symposium W on Multiscale Modeling at the Materials Research Society 2002 Spring Meeting, as a Member of Program Committee of 2001 International Conference on Process Modeling in Powder Metallurgy and continues to serve as a Member of the Editorial Board of the International Journal of Powder Metallurgy, as a Key Reader for Metallurgical Transactions, as a Reviewer for the DOE Laboratory Technology Program and initiated an In-Depth Compaction Research Discussion Group between Drexel students and engineers from Merck Co. (West Point, PA USA and Devon Labs, UK).
- **Mahmoud El-Sherif** represented Pennsylvania as an educator, entrepreneur, and inventor when he attended the National Republican Congressional Committee 2001 Tax Reform Workshop in Washington DC. The event included a series of strategy sessions with key members of Congress and the Bush Administration.
- **Richard Knight** was reelected to the Board of Directors of ASM International's Thermal Spray Society for a 3-year period, was the TSS Secretary/Treasurer (Oct. 2000 – Sept. 2001), was a Member of the Programming Committee for the 2001 International Thermal Spray Conference, Singapore, was Chair of the Training Committee, was a Member of the Information Development and Delivery Committee and the Program Committee of ASM International's Thermal Spray Society, taught the ASM/MEI 3-day Materials Engineering

Institute course (1.7 CEU) "Thermal Spray Technology" in Singapore, reviewed proposals for the U. S. Civilian Research and Development Foundation and the International Science and Technology Center and served as a Member of the NSF (DMII) NIRT Proposal Review Panel and as a Member of an EPA Review Panel.

- **Jeffrey Waldman** was Champion and Organizer of the Sessions on Structural Steels and Affordable Structures/Low Cost Manufacturing for the ASM International® Aeromat '2001 Conference and continued as a Fellow ASM International®, as a Member of ASM Awards Selection Committee, as a Director and Chair of the Long Range Planning Committee of the Philadelphia Chapter ASM International® and as a Member of the ASM International® Aeromat Event Management Committee, as Co-Chair NATO Task Group on Environmentally-Compliant Paint Removal and as a Member of Industry/Government Steering Group on Titanium Investment Castings for Aircraft Structures.
- **T.S. Venkataraman** serves as a member of the Board of Directors of the Delaware Valley Science Council (DVSC) which discovers, encourages and recognizes scientifically talented youth from high schools and also it serves as a resource to high school teachers and students. DVSC has also offered support to the proposed NSF Nanoscale Science and Engineering Center by Drexel University as an outreach partner, with Dr. Venkataraman as the direct contact between DVSC and Drexel University.

4.2 University/College Service Activities

- Kate Gomes, Michael Marucci, and Daniel McDonough were recognized for their service to the Department of Materials Science and Engineering with the A. W. Grosvenor Award.
- Yury Gogotsi is a Member of Faculty Senate and the following University Committees: Research Enterprise Building Committee, Study Abroad Advisory Committee, Council on Research (Drexel and MCP Hahnemann), Research Financial Reporting Committee (Drexel and MCP Hahnemann).
- Thomas Twardowski continued as the Associate Director of the Drexel University Center for Advanced Polymers.
- Antonios Zavaliangos was Elected as a Member of the College Advisory Board.
- Employee Service Awards were won by:
 - 30 years service – Judith Trachtman.
 - 10 years service – Richard Knight , Mahmoud El-Sherif, Michael Marmel.
 - 5 years service – Tamer El-Raghy , Jeffrey Waldman.

4.3 Service Awards and Honors

- Yury Gogotsi was listed in: Who's Who in America (2001), Who's Who Among America's Teachers (2000), International Who's Who of Professionals (2000).

- Surya Kalidindi was listed in Outstanding Intellectuals of the 21st Century (2000), Outstanding Scholars of the 21st Century (2000), Marquis Who's Who in America, 56th Edition, (2000).
- Mahmoud El-Sherif was awarded Man of the Year, an honor for community service and professional achievement, Presidential Seal of Honor for Exemplary Achievements in the Field of Fiber Optics and Order of International Ambassador, American Biographical Institute (2001), was appointed to serve on the Republican Congressional Leadership Council (RCLC), (2001) and the Republican Business Committee (RBC), 2000 and received "The Congressional Medal of Distinction" in recognition of Outstanding Leadership and Vision by the National Republican Congressional Committee, July 2001.

5.0 Challenges and Goals for AY 2001-02

Although, the department has accomplished a great deal in the past year, there is still significant room for improvement. The strategic plan (Appendix I) outlines the goals of the department for the next five years. The following specific areas will be targeted in AY 2001-02 (the departmental committees charged with these are listed in Appendix II).

1. New Faculty and Staff: Hire at least one new tenure track faculty member and a research programs coordinator (Department Head and Publicity/Awards Committee).
2. Undergraduate Enrollment Numbers: Streamline our efforts in undergraduate enrollment to maximize the efficiency and success rate (UG Affairs Committee).
3. Quality of Graduate Students : Develop new strategies for attracting highly qualified domestic and international graduate students (G Affairs Committee).
4. Facilities and Research Infrastructure: Further improve our facilities and research infrastructure. Develop plans for a centralized characterization laboratory that will be owned by the university, and managed by the department (Facilities Committee).
5. Strengthen Relations with Alumni and Industrial Partners: Revitalize the relationships with our distinguished alumni and industrial partners through the advisory board (Fund Raising Committee).