Dr. Ash B. Thakker, Ph.D., P.E., FASM, FSME, CMfgE

GLOBAL TECHNOLOGY EXPERTS
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US CITIZEN

EDUCATION

- **Ph.D., Virginia Polytechnic Institute and State University, 1974**
  Major: Engineering Science and Materials
- **MBA, Florida Institute of Technology, 1980**
  Major: Technology Management
- **MS, South Dakota Tech., 1971**
  Major: Structural Engineering
- **BE, Victoria Jubilee Technical Institute, 1970**
  Major: Civil Engineering

- **Registered Professional Engineer (P.E.), 1976**
  Virginia (007499) and Florida (0028394)
- **Certified Manufacturing Engineer (CmfgE), 1984-97**
  Society of Manufacturing Engineers (1918408)

AREA OF EXPERTISE

- Machinery & Equipment Failures (Skid Steer, Lawnmowers etc.)
- Repair / Preventive Maintenance
- Materials/Metallurgical
- Fatigue & Corrosion
- Slips-Trips-Falls
- Product Failure Analysis
- Aircraft and Engine Structural Failures
- Mechanical Metallurgy/Materials
- Structural Engineering
- Welding Procedures & Welded Joints
- Bicycle, Ladder, Slip & Fall
- Accident Reconstruction
- Auto Accident Investigation
- Tire Failure
- Construction Defect Analysis
- Electrical Failures
- Batteries, Motors & Generators

EXPERIENCE

- **3/81 – Current, Independent Materials/Forensics/Structural Engineering Consultant**: Failure analysis consultant on civil engineering, material selection, product liability and product development. Expertise in fracture mechanics, mechanical and metallurgical tests and analysis techniques. Over 300+ failures investigated including automotive bumpers, airplane and engine component failures, automotive axle to frame weld joints. Aluminum, titanium, polymers, ceramics and composite materials failure analysis. Internal company consultations on life assessment and durability of prototype components.
- **6/96 – Current, Director/Principal, Global Technology Experts**, **Marietta, GA 30339**: Forensics/Materials/Metallurgical/Mechanical/Structural-Engineering consultant. Accident reconstruction, product liability, materials and mechanical technology research, tech transfer and commercialization.
- **8/95-5/96 – Chief, Technology Integration Allison Engine Company/Rolls Royce, Aerospace group, PO Box 420, Indianapolis, IN 46206-0420:** Facilitated opportunities for integrating Allison engine company technical activities with the Rolls Royce group of companies.
- **7/83-8/95 – Sr. Manager, Materials and Mechanical Technologies, Rolls Royce Aerospace group, 2849 Paces Ferry Rd. Atlanta, GA. 30339:** Advanced materials component development programs, structural and durability analysis, life cycle cost. Project manager on number of coatings, fracture behavior of super alloys, polymer and ceramics composite components. Represented company on numerous professional national and international organizations.
- **11/78-7/83 – Group Leader, Materials Behavior Group Technologies, Pratt and Whitney Aircraft, PO Box 2691, West Palm Beach, FL 33402:** Principal Investigator on several NASA and DOD funded programs on fatigue and fracture behavior of titanium and super alloys. Structural assessment and durability assessment of engine components.
- **10/74-11/78 – Senior Engineer, Engineering Product Design Division, Alcoa Technical Center, PO Box 2970, Pittsburgh, PA. 15230:** Supervised fatigue, fracture and structural testing lab. Developed testing scheme for automotive aluminum bumpers to relate their cracking with alloy properties. Member of team for "the development of fatigue/fracture resistant aluminum alloys."
- **6/71-10/74 – Instructor, Engineering Science and Materials, Virginia Polytechnic Institute and State University, Blacksburg, VA. 24060:** Taught courses on engineering statistics and strength of materials. Research on "Accelerated testing of polymer composites". Participated on "Assessment of crash worthiness of automobiles program" funded by DOE.

HONORS & AWARDS

- Elected Fellow, ASM International (American Society of Metals) 1996
- Who's Who in America, 1993-97
- R. D. Sethna Graduate Scholarship, 1971.
- Sigma Xi Research Society of America, 1975
- Who's Who in Engineering, 1992-97
- Best Paper Award "Short Crack growth Behavior" AIAA , 1986

PROFESSIONAL ACTIVITIES

- Chairman, 1994 SAMPE Conference, (Society for Advancement of Material and Process Engineering)

- Sr. Director, SAMPE International Society, 1996-97
- Chairman, Atlanta ASM and SAMPE 1992-94
- Chairman, fracture/fatigue committee of SEM, 1990
- Member, American Society of Testing and Materials, 1976-97,
- Sr. Member, Society of Manufacturing Engineers, 1991-97
- Member, American Forensic Society, 1997
- Reviewer, ASTM, AIAA, SAMPE, ASM Journals
- Member, American Ceramic Society
- Member, Atlanta Claims Association and Southern Loss Association

PUBLICATIONS AND PRESENTATIONS

26 presentations at national/international meetings Contributed to over 37 publications in journals, over 50 company internal reports.

- Editorial Board of "Materials and Process" journal 1994-96
- Reviewer, American Society of Testing & Materials.

SELECTED PUBLICATIONS

1. **A Novel Architecture for an Integrated Fault Diagnostic/Prognostic System,** Zhang, G., Lee, S., Propes, N., Zhao, Y., Vachtsevanos, G., Thakker, A., Gailie, T; 2002 AAAI Spring Symposium Technical Proceedings, SS-02-03, ISBN 1-57735-148-7
2. **A Real Time Architecture for Prognostic Enhancements to Diagnostic Systems**, Propes, N., Lee, S., Zhang, G., Zhao, Y., Vachtsevanos, G., Thakker, A., Gailie, T.; MARCON 2002, Knoxville, TN, May 2002
3. **A New Confidence Prediction Neural Network for Machine Failure Prognosis** Khiripet, N., Vachtsevanos, G., Thakker, A., Gailie, T. Proceedings of Intelligent Ships Symposium IV, Philadelphia, PA, April 2-3, 2001
4. **Fault Prognosis Using Dynamic Wavelet Neural Networks,** Vachtsevanos, G., Wang, P., Gailie, T., Thakker, A.**,** Proceedings of AUTOTESTCON 2001 Conference, August 20-23, 2001.
5. **An Intelligent Approach to Prognostic Enhancements of Diagnostic Systems,** Vachtsevanos, G., Wang, P., Khiripet, N., Thakker, A., Gailie, T.**,** Proceedings of SPIE 15th Annual International Symposium on Aerospace/Defense Sensing, Simulation, and Controls, Orlando, Florida, April 16-20, 2001.
6. **Failure of a Titanium Metal Matrix Composite Shell under Internal Pressure,** Hook, D. A., Armanios, E. A., Dancilla, D.S., (Georgia Institute of Technology), Thakker A. B. (Allison Engine Company), Doorbar. P. (Rolls Royce, plc.)**,** Composite Materials: Fatigue and Fracture (Sixth Volume) ASTM STP 1285, 1997, Presented at ASTM Sixth Symposium on Composites: Fatigue and Fracture, Senver, Colorado, May 16-17, 1995.
7. **Free Vibration of a Metal Matrix Composite Shell with Circumferential Reinforcement,** Armanios, E. A., Badir, A. M.., Dancila, D. S. (Georgia Institute of Technology), Thakker A. B. (Rolls Royce Inc.), Doorbar, P. (Rolls Royce, plc.), 35th AIAA/ASME/AHS/ASC Structures, Structural Dynamics and Materials (SDM) Confence, Hilton Head, SC, April 18-20, 1994
8. **Fatigue Behavior of Cast XD Gamma Titanium Aluminide Alloys,** Larsern Jr., D.E., Behrendt, M., Walker, N., Thakker, A., Davidson, D., Clemmens, D.**,** Fatigue and Fracture of Ordered Intermetallic Materials 1 Conference, Pittsburgh, Pennsylvania, Oct. 17-21, 1993.

9. **Application of Titanium Aluminides in Gas Turbine Components,** Postans, P.J, Cope, M. T., Moorhouse S.(Rolls Royce Plc, England),Thakker, A. B. (Rolls Royce Inc., Atlanta, GA.), Presented at 7th World Titanium Conference, S. Diego, CA, July 92.
10. **Surfprep Flash-Lamp Depaint System Evaluation,** Toriz, F. C.; Thakker, A. B.; Gupta, S. K. ;(Rolls Royce Inc, Atlanta, GA)**,** Doxstader, R. (A & R Industries, Oceanside, CA)**,** 17th International Conference on Metallurgical Coatings and 8th International Conference on Thin Films; San Diego, CA, USA; 1990 Apr. 2-6, Surface & Coatings Technology v 44 n 1-3 Dec. 10 1990. p 1035-1046.
11. **Ion Implantation to Palliate Machining Damage in Ceramics,** A.B. Thakker, F. C. Toriz (Rolls Royce Inc, Atlanta, GA)**,** R. Bhattacharya, P. Pronko (UES Corp, Dayton, OH)**,** DOE contract report, Aug88-Aug 90.
12. **Flight Service Evaluation of Thermal Barrier Coatings by Physical Vapor Deposition at 5200 H,** Toriz, F. C.; Thakker, A. B.; Gupta, S. K. (Rolls-Royce Inc, Atlanta, GA,) 16th International Conference on Metallurgical Coatings (ICMC) - Part I (of 3); San Diego, CA, USA; 1989 Apr. 17-21. Surface & Coatings Technology v 39-40 1-3 PT1 Dec. 1 1989. p161-172.
13. **Thermal Barrier Coatings For Jet Engines,** Toriz, F. C.; Thakker, A. B.; Gupta, S. K. (Rolls-Royce, Inc., Atlanta, GA). ASME Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, Netherlands, June 6-9, 1988. 9 p.ASME PAPER 88-GT-279.
14. **Particulate Erosion of Ceramic Thermal Barrier Coatings,** Toriz, F. C. , Thakker, A. B. and Gupta, S. K.(Rolls Royce Inc, Atlanta, GA), Presented at American Ceramic Society, Cocoa Beach, FL, Nov 1987**.** Published 40th Pacific Coast Meeting Proceedings, 8-A-87P, 1988.
15. **Ion Implantation of Silicon Nitride for Rolling Element Bearing Applications,** Morrison, J. A.; Thakker, A. B.; (Rolls-Royce, Inc., Atlanta, GA). Armini, A. J. (Surface Alloys Inc, Boston, MA)**,** ACS Annual Conference on Composites and Advanced Ceramic Materials, 12th, Cocoa Beach, FL, Jan. 17-22, 1988. Ceramic Engineering and Science Proceedings, vol. 9, Sept.-Oct. 1988, p. 1265-1275.
16. **Development of Fracture Toughened Ceramics for Rolling Element Bearings,** A. B. Thakker, J. A. Morrison (Rolls Royce Inc, Atlanta, GA), A. J. Armini (Surface Alloys Inc, Boston, MA),Final Report, NASA Lewis Research Center, Contract NAS3-25127, NASA Report FR87-09, August, 1987.
17. **A Philosophy for Thermal Barrier Coating Design and its Corroboration by 10000-H Service Experience on RB211 Nozzle Guide Vanes,** Bennett, A; Toriz, FC; Thakker, AB. (Rolls-Royce plc; Rolls-Royce Inc), Surface & Coatings Technology, 1987, V32, N1-4, P359-375.
18. **An Experimental and Numerical Investigation of the Growth and Coalescence of Multiple Fatigue Cracks at Notches,** Thakker, A. B. (Pratt & Whitney Aircraft, West Palm Beach, FL), Grandt, A. F. Jr.; Tritsch, D. E. (Purdue Univ., West Lafayette, IN) Fracture Mechanics: Seventeenth Volume, Seventeenth National Symposium on Fracture Mechanics; Albany, NY, USA; 1984 Aug. 7-9.ASTM Special Technical Publication 905, 1986. p 239-252.
19. **Fracture Mechanics of Multiple Crack Initiations. An Application for Fracture Mechanics Analysis of Gas Turbine Engine Disks.** Interim Report, Feb. 1981 - June 1983. Cowles, B A; Thakker, A B; King, G E. (Pratt & Whitney Aircraft, West Palm Beach, Florida, Engineering Div.).AD-A162998/XAB; PW/ED/FR-18778; AFWAL-TR-85-4110; October 1985.
20. **Low Strain, Long Life Creep Fatigue of AF2-1DA and INCO 718.** Thakker, A B; Cowles, B A. (Pratt & Whitney Aircraft Group, West Palm Beach, Florida, Government Products Div.) NASA-CR-167989; NAS 1.26:167989; FR-15652; April 1983
21. **Low Cycle Fatigue Damage Accumulation,** Green, R.N. Naval Air Systems Command Report FR-16285, December 1982

22. **Ranking 7XXX aluminum alloy fatigue crack growth resistance under constant amplitude and spectrum loading,** Bucci, R J; Staley, J T; Thakker, A B; Sander, T H; Sawtell, R R. (Alcoa Research Laboratories, Alcoa Center, PA).
23. **Effect of Load Spectrum Variables on Fatigue Crack Initiation and Propagation in ASTM Symposium Proceedings, 1980, p. 41-78,** ASTM Symposium, San Francisco, CA, May 21, 1979.
24. **Effects of Microstructure on Fatigue Crack Growth of 7XXX Aluminum Alloys under Constant Amplitude and Spectrum Loading. Final Report**, T H, Jr.; Sawtell, R R; Staley, J T; Bucci, R J; Thakker, A B. (Aluminum Co. of America, Alcoa Center, PA). AD-A057129; REPT-56-78-AF8; April 1978.
25. **Improving Fatigue Resistance of Aluminum Aircraft Alloys,** Staley, James T.; Truckner, William G.; Bucci, Robert J.; Thakker, Ashok B. (Alum Co. of Am, Alcoa Center, Pa), Aluminum v 53 n 11 Nov. 1977 p 667-669.
26. **Effects of Microstructure on Fatigue Crack Growth of A1-Zn-Mg-Cu Alloys,** Staley J T; Truckner W G; Bucci R J; Thakker A B. (Alcoa Labs), Presented at 106th Annual AIME meeting, March 9, 1977, Atlanta GA, Jom-Journal of Metals, 1976, V28, N12, Pa48.
27. **Vibration as NDT Tool for Composites,** Presented at TMS-AIME Conference on Meeting the Materials Challenge, Niagara Falls, New York, September 1976.
28. **Effects of Microstructure on Fatigue Crack Growth of High Strength Aluminum Alloys. Final Technical Report, May 1974 - May 1976,** Truckner, W G; Staley, J T; Bucci, R J; Thakker, A B. (Aluminum Co. of America, Alcoa Center, PA.) AD-A037156; AFML-TR-76-169; REPT-56-76-AF5; August 1976.
29. **Effects of Microstructure on Fatigue Crack Propagation of Al-Cu-Mg-Mn Alloys,** Truckner, W.G., Staley, J.T., Mauney, D.A. Presented at International Conference of Materials, Boston, August 1976.
30. **Environmental Effects on Fiber-reinforced Composites,** Heller R A; Brinson H F; Thakker AB. (Virginia Polytech Inst & State Univ, Dept. Engni & Mech.), Presented at IV Inter- American Conference on Materials, Polymer Engineering and Science, 1975, V15, N11, P781-788
31. **Accelerated Characterization of Fiber/Epoxy Composites. Part 1: Viscoelastic Methods. Final Report, 1 July 1972 - 30 Sept. 1974,** Thakker, A B; Brinson, H F; Heller, R A. (Virginia Polytechnic Inst.and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.)**,** AD-A014266; AFML-TR-74-256-PT-1; Feb. 1975.
32. **Environmental Effects on Fiber Reinforced Composites,** Heller, R. A.; Brinson, H. F.; Thakker, A. B. (Va. Polytech Inst. & State Univ., Blacksburg), International Conference on Mater Technology, 4th, Proc, Caracas, Venezuala, June 29-July 4 1975.p 464-471.
33. **Statistical Evaluation of Mechanical Properties for Composite Materials,** Heller, R.A, Heller, A.S., ASCE, EMD Specialty Conference, Stanford, California, June 1974.
34. **A Response Surface for the Complex Modulus of Composite Materials (Forced Vibration Tests). Technical Report, 1 July 1972 - 30 April 1974,** Arthur, C E; Heller, A S; Thakker, A B. (Virginia Polytechnic Inst. and State Univ., Blacksburg. College of Engineering.)**,** AD-A001978; AFML-TR-74-185; October 1974.
35. **Viscoelastic Characterization of Angle Ply Advanced Composites** (including boron and graphite reinforced materials). Ph.D. Thesis, Thakker, A B. (Virginia Polytechnic Inst. and State Univ., Blacksburg.), Published 1974.
36. **Temperature Dependence of the Complex Modulus for Fiber Reinforced Materials,** Heller, R A; Thakker, A B; Arthur, C E. (Virginia Polytechnic Institute and State Univ. Blacksburg, Va.) Composite reliability in ASTM Proceedings, 1975, p. 298-308, ASTM Symposium, Las Vegas, NV, April 15-16, 1974.

37. **Time and Temperature Dependence of Boron Epoxy and Graphite Epoxy Laminates,** Technical Report, 1 July 1972 - 30 June 1973, Heller, R A; Swift, G W; Stinchcomb, W W; Thakker, A B; Liu, J C. (Virginia Polytechnic Inst. and State Univ. Blacksburg.) AD-774028; AFML-TR-73-261; November 1973

PRESENTATIONS (Not listed above)

1. **Analysis and Testing of Titanium Metal Matrix Composite Shell with Circumferential Reinforcement** ASTM Twelfth Symposium on Composite Materials: Testing and Design, Montreal, Quebec, May 16-17, 1994.A. B. Thakker, E. A. Armenios, A. M. Badir, A. M..
2. **Advanced Materials Application in Gas Turbine Engines** A. B. Thakker (Rolls Royce Inc., Atlanta, GA), ASM/ TMS, November1991, Georgia Tech, Atlanta, GA
3. **Short Crack Growth Behavior of Titanium Alloys,** A. B. Thakker (Rolls Royce Inc, Atlanta, GA.), C. Howland (Rolls Royce Plc, England)**,** WESTEC 90 Conference and Exhibition, March 26-29, 1990, Los Angeles, CA.
4. **Short Crack Growth Behavior,** A. B. Thakker (Rolls Royce Inc., Atlanta, GA.)**,** AIAA Aerospace Technology Symposium, Atlanta, GA. 1986. (Best Session Speaker Award).
5. **Disk Lug Low Cycle Fatigue Life Prediction,** A. B. Thakker, B. A. Cowles (Pratt & Whitney Aircraft, W. Palm Beach, FL)**,** ASME Gas Turbine Conference, Houston, TX 1980.
6. **Effects of Microstructure on Fatigue Crack Propagation of Al-Cu-Mg- Mn Alloys,** W. G. Truckner, A. B. Thakker, J. T. Staley, and D. A. Mauney (Alcoa Tech Center, PA)**,** Presented at International Conference on Materials, August 1976, Boston, MA.
7. **Vibration as NDT Tool for Composites,** A. B. Thakker (Alcoa Technical Center, Alcoa Center, PA), TMS- AIME Conference on "Meeting the Materials Challenge", September 1976, Niagara Falls, NY
8. **Chaired several conference sessions on Materials Technology** at Conferences organized by American Ceramic Society (ACS), Society for Experimental Mechanics (SEM), American Society for Testing and Materials (ASTM), American Institute of Aeronautics and Astronautics (AIAA) and ASM.
9. **Over 40 Reports on Company Internal Research and Development (IR&D) funded projects on Advanced Materials behavior which are not listed here.**

CONTINUING EDUCATION

- Numerous short courses and seminars on manufacturing technologies, material defect analysis, damage tolerant approaches to component design.
- ABA conference on “Expert testimony, technology and law”, Washington DC. 1997

OTHER ACTIVITIES

- Toastmasters International (78-95)
- Vinings Club, GA. Social Committee (92-95)
- Advisor, Junior Achievement Program (81-83)
- Chairman, International Students Association, Virginia Tech (72-73)
- Virginia Tech. Alumni Association. (94-97)
- Board of Director, Metro Atlanta GYSTC (non profit)
- Advisory Board, NASA Space Grant Consortium-Georgia