

## **Daniel P. Dennies, Ph.D., P.E., FASM Principal**

### **Professional Profile**

Dr. Daniel Dennies is a licensed metallurgical Professional Engineer (P.E.) in the state of California. He has over 35 years of experience in various raw material, forging, aerospace, and aircraft related industries as a technical specialist, technical manager, and program manager. The majority of his career has been in the aerospace industry working on projects such as the Space Shuttle Main Engine, the National Launch System, the National Aerospace Plane, expendable launch systems like Delta and Titan, and the International Space Station. He has also worked on other projects including commercial aircraft such as the Boeing 787, military aircraft such as the C17 Transport and B1-B Bomber, proprietary programs such as the Ground Based Missile Defense and the X-37B Experimental Reusable Unmanned Space Plane. In addition, he has worked on projects in various industries such as construction, plumbing, food processing, land based turbines, biomedical devices, fasteners, and power generation /energy.

Dr. Dennies has accumulated experience with a wide variety of materials, processes, and test mechanisms through his association with the design, testing, failure analysis, and manufacturing aspects of these programs. His broad areas of expertise include failure analysis, engineering design support, material and process selection, material testing, manufacturing support, customer or supplier interaction, as well as program management.

He is a member of multiple professional organizations, where he has served on the board of trustees and several national committees, many as chairman. He has multiple professional awards and was awarded a patent in 1988. Dr. Dennies has taught multiple courses a year since 2000, has given numerous technical presentations, and is highly published including a book on failure analysis in 2005.

### **Academic Credentials and Professional Honors**

Ph.D., Engineering, University of California, Davis, 1993  
M.B.A., Management, Pepperdine University, 1984  
M.S., Materials Engineering, University of Southern California, 1981  
B.S., Metallurgical Engineering, California Polytechnic State University, 1979

Best Paper of 2010 Award, *Journal of Failure Analysis and Prevention*, 2011  
George Roberts Award, ASM Materials Education Foundation, 2011  
Technical Fellow, The Boeing Company, 2008  
Prestigious Engineering Achievement Award, Orange County Engineering Council, 2005  
Allan Ray Putnam Award, ASM International, 2004  
Associate Technical Fellow, The Boeing Company, 2003  
Certificate of Recognition, The Boeing Company, 2003

Fellow, ASM International, 2002  
Instructor of Merit Award, ASM International, 2002  
AM&P Magazine Profile, ASM International, 2002  
Silver Snoopy Award, NASA, 1999  
Superior Quality Performance Award, The Boeing Company, 1998  
Multiple “Pride at Boeing” Awards, The Boeing Company, 1999-2009  
Technical Utilization Award, NASA, 1985  
Multiple “Rockwell Suggestion Awards,” Rockwell Corporation, 1980-1986  
Elected Member of the Tau Beta Pi Engineering National Honor Society, 1979  
Elected Member of the Phi Kappa Phi National Honor Society, 1979  
Elected Member of the Blue Key National Honor Society, 1979  
ASM Scholar, ASM International, 1978

### **Licenses and Certifications**

Registered Professional Metallurgical Engineer, California, #1750  
Transportation Worker Identification Credential (TWIC) Cardholder  
Master Instructor, Professional Association of Dive Instructors (PADI), #163984  
Emergency First Responder Instructor Trainer (First Aid and CPR)

### **Patents**

United States Patent # 4,761,187: Method of Improving Stress Corrosion Resistance of Alloys, August 2, 1988.

### **Books Authored**

Dennies DP. How to Organize and Run a Failure Investigation. Published by ASM International, August 2005.

Dennies DP. (Contributor) Understanding How Components Fail. Third Edition, Published by ASM International, October 2013.

Dennies DP. Robot Wars in the City of Materials. Published by iUniverse LLC, October 2013

### **Publications**

Dennies DP, Kupkovits R. Extended room-temperature creep testing of Grade 2 CP titanium plate using notch tensile samples. Journal of Failure Analysis and Prevention 2016 Feb; 16(1):4-8.

Dennies DP, DeVillier A. Characterization of an undermatched weld. Journal of Failure Analysis and Prevention 2015 June; 15(3):337–343.

Dennies DP, DeVillier A. How things go wrong—Case studies in failure analysis & R&D. Proceedings, IMS Microstructural Characterization of Aerospace Materials and Coatings Conference and Exposition, Long Beach, CA, May 11–14, 2015.

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Dennies DP, Kupkovits R. Room temperature creep testing of Grade 2 CP titanium plate using notch tensile samples. *Journal of Failure Analysis and Prevention*, 2014 Aug; 14(4):437–442.

Dennies DP, Pompay M, Lupia A, Martinez, J. Microstructure phase characterization of MMFX<sub>2</sub> steel alloy by electron backscatter diffraction (EBSD). *Proceedings, Material Science and Technology Conference 2013, Failure Analysis Symposium, Montreal, Quebec, Canada, October 27–31, 2013.*

Dennies DP. Proposed theory for the hydrogen embrittlement resistance of martensitic precipitation age-hardening stainless steels such as Custom 455. *Journal of Failure Analysis and Prevention* 2013 Aug; 13(4):433–436.

Dennies DP, Martinez, J. Electron backscatter diffraction (EBSD) characterization of MMFX<sub>2</sub> steel alloy. *Proceedings, IMS Quantitative Metallography Conference and Exposition, San Antonio, TX, April 3–5, 2013.*

Dennies DP, Pompay MW, Lupia A. MMFX<sub>2</sub> steel alloy material characterization study. *Proceedings of the Steel Product Metallurgy and Applications Symposium, Materials Science & Technology 2012, Pittsburgh, PA, October 7–11, 2012.*

DeVries PH, Ruth KT, Dennies DP. Counting on fatigue: Striations and their measure. *Journal of Failure Analysis and Prevention* 2010 Aug; 10(2):120–137. JFAP Best Paper of 2010 Award.

Dennies DP. A review of the findings and recommendations of the Columbia Accident Investigation Board. *Journal of Failure Analysis and Prevention* 2006 Feb; 6(1):17–21.

Dennies DP. The future of failure investigation in the aerospace industry. *Journal of Failure Analysis and Prevention* 2006 Feb; 6(1):22–27.

Dennies DP. Apollo 1 fire and its effect on the space industry. *Proceedings, Material Science and Technology Conference 2005, Failure Analysis Symposium, pp. 31–46, Pittsburgh, PA, September 25–28, 2005.*

Dennies DP, Fischer MA. Flaws in large 7050 aluminum ring rolled forgings. *Journal of Failure Analysis and Prevention* 2004 Feb; 4(1):63–68.

Dennies DP. The organization of a failure investigation. *Journal of Failure Analysis and Prevention* 2002 Jun; 2(3):33–41.

Dennies DP. Microstructure comparison of high strength Inconel 718 nuts. *Proceedings, International Symposium on Superalloys 718, 625, 706 and Various Derivatives, pp.443–454, Pittsburgh PA, June 17–20, 2001.*

Dennies DP. Laboratory experiment capabilities aboard the International Space Station. Proceedings, 13th International Symposium on Experimental Methods for Microgravity Materials Science, Long Beach, CA, June 11–14, 2001.

Dennies DP, Toosky R. A 25 year study of titanium hydride formation by uphill diffusion in dissimilar titanium welds. Proceedings, ASMI and AWS 5<sup>th</sup> International Conference on Trends in Welding Research, pp.657–662, Pine Mountain, GA, June 1–5, 1998,

Toosky R, Van Raden R, Dennies DP. Evaluation of titanium hydride formation in resistance seam welded dissimilar titanium joints. Proceedings, ASMI and AWS 5<sup>th</sup> International Conference on Trends in Welding Research, pp. 628–631, Pine Mountain, GA, June 1–5, 1998.

Dennies DP, Gibson, VA, Horn RM. Hydrogen evaluation of Incoloy 909 for the NLS liquid hydrogen TPA turbine. Summary Proceedings, 5<sup>th</sup> Workshop on Hydrogen-Materials Interactions, pp. 369–378, Scottsdale, AZ, September 23–25, 1992.

Dennies DP, Gibeling J. The effect of thermal treatment on the cryogenic mechanical properties of Cast 5Al-2.5Sn ELI Titanium. Proceedings, 7<sup>th</sup>World Conference on Titanium, pp. 121–129, San Diego, CA, June 28–July 2, 1992.

Dennies DP, Gibson, VA, Horn RM. Hydrogen evaluation of Incoloy 909 for the NLS liquid hydrogen TPA turbine. Proceedings, 1992 Conference on Advanced Earth to Orbit Propulsion Technology, Workshop on Hydrogen Effects on Materials in Propulsion Systems, pp. 95–100, NASA Marshall Space Flight Center, AL, May 19–21, 1992.

Gibson, VA, Dennies DP, Horn RM. Assessment of candidate rocket propulsion materials in a gaseous hydrogen environment. Proceedings, 1992 Conference on Advanced Earth to Orbit Propulsion Technology, Workshop on Hydrogen Effects on Materials in Propulsion Systems, pp. 85–94, NASA Marshall Space Flight Center, AL, May 19–21, 1992.

Dennies DP. Cast 5Al-2.5Sn ELI titanium heat treatment study for low cost cryogenic turbopump rotating hardware. AIAA/SAE/ASME 27th Joint Propulsion Conference, AIAA Paper No. 91–1927, Sacramento, CA, June 24–26, 1991.

Dennies DP, Janser G. Thermomechanical processing study of A286 for low cost turbine materials selection. AIAA/SAE/ASME 27th Joint Propulsion Conference, AIAA Paper No. 91-1928, Sacramento, CA, June 24–26, 1991.

Dennies DP, Smith J. Improved material property estimates using small sample sizes. AIAA/SAE/ASME 27th Joint Propulsion Conference, AIAA Paper No. 91-1926, Sacramento, CA, June 24–26, 1991.

Dennies DP, Swain R. Low cost design guidelines for the Aerojet ALS advanced development LH2 Turbopump. AIAA/SAE/ASME 27th Joint Propulsion Conference, AIAA Paper No. 91-2036, Sacramento, CA, June 24–26, 1991.

Dennies DP, Parsons TD. Oxidation characteristics of 440C CRES in GOX Environments. Lubrication Engineering, ASLE 1986 Oct; 42(10):601–607.

Kumar A, Dennies DP, Parsons TD. Surface analysis of thin oxide films on a stainless steel. Proceedings, International Symposium for Testing and Failure Analysis (ISTFA), pp. 322–328, Los Angeles, CA, October 22–26, 1984.

Dennies DP. Attention graduating engineers, requirement: Communication skills. USC Engineer Magazine 1984 Winter; 35(2):15–16.

Dennies DP. Attention graduating engineers, requirement: Communication skills. Metals Progress Magazine, ASM International Editorial Section, December 1984.

### **Presentations and Published Abstracts**

Budiansky N, Dennies, DP, Forman J, Wong D, Tucker J, Computed X-ray Tomography of Powder Metallurgy Product for Rapid, Quantitative Size and Shape Distribution Analysis, Microscopy & Microanalysis 2016, Additive Manufacturing Symposium, Columbus, OH, July 24-28, 2016.

Dennies DP, Kupkovits R. Extended Room Temperature Creep Testing of Grade 2 CP Titanium Plate Using Notch Tensile Samples. Proceedings, Material Science and Technology Conference 2015, Failure Analysis and Prevention Symposium, Columbus, OH, October 4-8, 2015.

Dennies DP. Career Development Strategy Today. Proceedings, Material Science and Technology Conference 2015, Perspectives for Emerging Materials Professionals Symposium, Columbus, OH, October 4-8, 2015.

Garcia-Leiner M, Dennies DP, Yardimci A. High Performance Polymers in Additive Manufacturing Processes: Understanding Process, Structure & Property. Microscopy & Microanalysis 2015, Additive Manufacturing Symposium, Portland, OR, August 2-6, 2015.

Dennies DP, DeVillier A. How things go wrong—Case studies in failure analysis & R&D. Proceedings, IMS Microstructural Characterization of Aerospace Materials and Coatings Conference and Exposition, Long Beach, CA, May 11–14, 2015.

Dennies DP. Failure analysis in the aerospace industry—What’s next? Aeromat 2015 Conference and Exposition, Long Beach, CA May, 11–14, 2015.

Dennies DP, DeVillier A. Characterization of an undermatched weld. Proceedings, Material Science and Technology Conference 2014, Failure Analysis Symposium, Pittsburgh, PA, October 12–16, 2014.

Dennies DP, Fulmer S. Modeling of the plastic constraint in an undermatched weld. Proceedings, Material Science and Technology Conference 2014, Failure Analysis Symposium, Pittsburgh, PA, October 12–16, 2014.

Ibrahim Z, Dennies, DP. Gas turbine common issues, failure investigation and root cause analysis. The 39<sup>th</sup> Annual Fall Combustion Turbine Operations Technical Forum (CTOTF-2014), San Diego, CA, September 7–11, 2014.

Dennies DP, Pline T, Conley D, Kupkovits R. Room temperature creep testing of Grade 2 CP Titanium plate using notch tensile samples. Proceedings, Material Science and Technology Conference 2013, Failure Analysis Symposium, Montreal, Quebec, Canada, October 27–31, 2013.

Dennies DP, Pompay M, Lupia A, Martinez, J. Microstructure phase characterization of MMFX<sub>2</sub> steel alloy by electron backscatter diffraction (EBSD). Proceedings, Material Science and Technology Conference 2013, Failure Analysis Symposium, Montreal, Quebec, Canada, October 27–31, 2013.

Dennies DP, Martinez, J. Electron backscatter diffraction (EBSD) characterization of MMFX<sub>2</sub> Steel Alloy. Proceedings, IMS Quantitative Metallography Conference and Exposition, San Antonio, TX, April 3–5, 2013.

Dennies DP. Microstructure comparison of high strength Inconel 718 nuts. Aerospace Fastener Symposium, Orange Coast Chapter of ASM International, Irvine, CA, November 5, 2012.

Dennies DP. Sample preservation, collection, cleaning and storage as a root cause in failure analysis. Materials Science & Technology 2012, Failure Analysis and Prevention Symposium, Pittsburgh, PA, October 7–11, 2012.

Dennies DP, Pompay MW, Lupia A. MMFX<sub>2</sub> steel alloy material characterization study. Materials Science & Technology 2012, Steel Product Metallurgy and Applications Symposium, Pittsburgh, PA, October 7–11, 2012.

Dennies DP. Sample preservation, collection, cleaning and storage in failure analysis. Microscopy & Microanalysis 2012, Failure Analysis of Structural Materials Symposium, Phoenix, AZ, July 29–August 2, 2012.

Dennies DP. Failure analysis of flight hardware made from Custom 465. Material Science and Technology 2010, Failure Analysis and Prevention Symposium, Houston, TX, October 17–21, 2010.

Dennies DP, Wert D. Precipitation aging study of Custom 465 CRES H1050 condition to support flight hardware failure analysis. Material Science and Technology 2010, Failure Analysis and Prevention Symposium, Houston, TX, October 17–21, 2010.

Dennies DP. Hydrogen embrittlement testing of Custom 455 CRES for International Space Station hardware. Material Science and Technology 2010, Failure Analysis and Prevention Symposium, Houston, TX, October 17–21, 2010.

Dennies DP, Golden J. Failure analysis of flexhoses for the International Space Station. Material Science and Technology 2010, Failure Analysis and Prevention Symposium, Houston, TX, October 17–21, 2010.

Dennies DP. Strategy for career development. Material Science and Technology 2010, Perspective for Emerging Materials Professionals: Early Strategies for Career Development Symposium, Houston, TX, October 17–21, 2010.

DeVries PH, Ruth KT, Dennies DP. Counting on fatigue: striations and their measure. Proceedings, Microscopy and Microanalysis 2009 Conference, Instrumentation and Techniques Symposia, Failure Analyses: Practical Metallography/Fractography in Case Studies Session, Richmond, VA, July 26–30, 2009.

Dennies DP. Evaluation of a trimetallic joint. Proceedings, Microscopy and Microanalysis 2008 Conference, Physical Sciences Symposia, Failure Analysis: Real World Applications and Case Studies Session, Albuquerque, NM, August 3–7, 2008.

Wooten J, Dennies DP. Metallographic evaluation of electron beam melted Ti-6Al-4V. Proceedings, Microscopy and Microanalysis 2008 Conference, Physical Sciences Symposia, Failure Analysis: Real World Applications and Case Studies Session, Albuquerque, NM, August 3–7, 2008.

Dennies DP. Engineering challenges of emerging processes. Material Science and Technology 2007, What We Can Learn From Failure Analysis Symposium, Detroit, MI, September 16–19, 2007.

Dennies DP. Apollo 1 Fire and its effect on the space industry. Material Science and Technology 2005, Failure Analysis Symposium, Pittsburgh, PA, September 25–28, 2005.

Dennies DP. A review of the findings and recommendations of the Columbia Accident Investigation Board. Materials Solution Conference and Exposition 2004, Failure Analysis and Prevention Symposium, Columbus, OH, October 18–20, 2004.

Dennies DP. The future of failure investigation in the aerospace industry. Materials Solution Conference and Exposition 2004, Failure Analysis and Prevention Symposium, Columbus, OH, October 18–20, 2004.

Dennies DP. Corrosion of a titanium shaft. Materials Solution Conference and Exposition 2003, Failure Analysis and Prevention Symposium, Pittsburgh, PA, October 13–15, 2003.

Dennies DP, Fischer MA. Flaws in large 7050 aluminum ring rolled forgings. Materials Solution Conference and Exposition 2003, International Symposium on Aluminum Applications, Pittsburgh, PA, October 13–15, 2003.

Dennies DP. How to organize and run a failure investigation. Materials Solution Conference and Exposition 2002, Failure Analysis and Prevention Symposium, Columbus, OH, October 7–12, 2002.

Dennies DP. Microstructure comparison of high strength Inconel 718 nuts. ASM Materials Solution Week, Practical Failure Analysis: The Symposium, Indianapolis, IN, November 5–8, 2001.

Dennies DP. Microstructure comparison of high strength Inconel 718 Nuts., International Symposium on Superalloys 718, 625, 706 and Various Derivatives, Pittsburgh PA, June 17–20, 2001.

Dennies DP. Laboratory experiment capabilities aboard the International Space Station, 13th International Symposium on Experimental Methods for Microgravity Materials Science, Long Beach, CA, June 11–14, 2001.

Dennies DP. The International Space Station—Where is it today? Aeromat 2001, 12th Annual Advanced Aerospace Materials and Processes Conference and Exposition, Long Beach, CA, June 11–14, 2001.

Dennies DP, Lee T. The effect of atomic oxygen exposure on a space station fastener lubricant. Aeromat 2001, 12th Annual Advanced Aerospace Materials and Processes Conference and Exposition, Long Beach, CA, June 11-14, 2001.

Dennies DP. Hydrogen Embrittlement of 52100 Bearings for the International Space Station by Thin Dense Chrome Plating Process," by Dennies DP, Aeromat 2000, the 11th Annual Advanced Aerospace Materials and Processes Conference and Exposition, Seattle, WA, June 26-29, 2000.

Dennies DP. Mechanical property failure of Space Station trunnion pins due to microstructure and heat treatment. Aeromat 2000, 11th Annual Advanced Aerospace Materials and Processes Conference and Exposition, Seattle, WA, June 26–29, 2000.

Dennies DP, Toosky R. A 25 year study of titanium hydride formation by uphill diffusion in dissimilar titanium welds. ASMI and AWS Fifth International Conference on Trends in Welding Research, Pine Mountain, GA, June 1–5, 1998.

Dennies DP, Van Raden R, Toosky R. Evaluation of titanium hydride formation in resistance seam welded dissimilar titanium joints. ASMI and AWS Fifth International Conference on Trends in Welding Research, Pine Mountain, GA, June 1-5, 1998.



Dennies DP, Gibeling J. The effect of thermal treatment on the cryogenic mechanical properties of cast 5Al-2.5Sn ELI Titanium. 7<sup>th</sup> World Conference on Titanium, San Diego, CA, June 28–July 2, 1992.

Dennies DP, Horn R. Hydrogen evaluation of Incoloy 909 for the NLS liquid hydrogen TPA turbine. 1992 Conference on Advanced Earth to Orbit Propulsion Technology, NASA/Marshall Space Flight Center, AL, May 19–21, 1992.

Dennies DP, Horn R. Assessment of candidate rocket propulsion materials in a gaseous hydrogen environment. 1992 Conference on Advance Earth Orbit Propulsion Technology, NASA/Marshall Space Flight Center, AL, May 19–21, 1992.

Dennies DP. Cast 5Al-2.5Sn ELI Titanium heat treatment study for low cost cryogenic turbopump rotating hardware. AIAA/SAE/ASME 27th Joint Propulsion Conference, AIAA Paper No. 91-1927, Sacramento, CA, June 24–26, 1991.

Dennies DP. Thermomechanical processing study of A286 for low cost turbine materials selection. Aeromat 1991, 2<sup>nd</sup> Annual Advanced Aerospace Materials and Processes Conference and Exposition, Long Beach, CA, May 20–23, 1991.

Dennies DP, Smith J. Improved material property estimates using small sample sizes. AIAA/SAE/ASME 27th Joint Propulsion Conference, AIAA Paper No. 91-1926, Sacramento, CA, June 24–26, 1991.

Dennies DP, Swain R. Low cost design guidelines for the Aerojet ALS Advanced Development LH2 Turbopump. AIAA/SAE/ASME 27th Joint Propulsion Conference, AIAA, Paper No. 91-2036, Sacramento, CA, June 24–26, 1991.

Dennies DP, Parsons T. Oxidation characteristics of 440C CRES in GOX environments. 40th Annual ASLE Meeting, Las Vegas, NV, May 6–9, 1985.

Dennies DP. A review of new materials, fabrication techniques and coatings for advanced turbopump bearing applications. 40th Annual ASLE Meeting, Las Vegas, NV, May 6–9, 1985.

Kumar A, Dennies DP, Parsons TD. Surface analysis of thin oxide films on a stainless steel. International Symposium for Testing and Failure Analysis (ISTFA), Los Angeles, CA, October 22–26, 1984.

### **Teaching Experience**

- Instructor, ASM International, 2000–present

## **Editorial Boards/Contributing Editor/Peer Reviewer**

- Journal of Failure Analysis and Prevention, 2002–2016
- Journal of Materials Engineering and Performance, 2001–2006
- ASM Handbook 11 on Failure Analysis, 10th edition, 2002

## **Prior Experience**

- Senior Managing Engineer, Exponent, 2011-2016
- Independent Consultant and Senior Managing Consultant, ESI, 2008–2011
- Independent Metallurgical Consultant, 1993–2008
- Technical Fellow, Metallurgy and Failure Analysis, The Boeing Company, 1996–2010
- Senior Regional Metallurgist, Carpenter Technology Corporation, 1994–1996
- Senior Engineering Specialist, GenCorp, Aerojet Propulsion and Ordnance Divisions, 1988–1994
- Technical Director & Quality Control Manager, Arcturus Manufacturing Corporation, 1986–1988
- Technical Manager – Material, Rohr Industries, Inc., 1985–1986
- Member of the Technical Staff, Rocketdyne Division, Rockwell International Corporation, 1979–1985

## **Professional Affiliations**

- American Society for Materials International (ASMI)
  - Member since 1977
  - Society Board of Trustees, 2006–2009
  - Foundation Board of Trustees, 2004–2007
  - Various National Committees, 1996–present
  - MS&T and Aeromat Conference Organizer and Session Chair, 2001–present
  - LA Chapter Executive Committee, 1994–present
- Failure Analysis Society (FAS)
  - Member since 2016 (Founding Member)
  - Society Board of Trustees, 2016–Present
- International Metallographic Society (IMS)
  - Member since 2005
  - Board of Directors, 2010–Present
  - M&M Conference Organizer and Symposium Chair, 2005, 2007–2016
- American Society of Mechanical Engineers (ASME)
  - Member since 1984
- American Welding Society (AWS)
  - Member since 1979
- Society for the Advancement of Materials and Process Engineering (SAMPE)
  - Member since 1989
- National Association of Corrosion Engineers (NACE)

- Member since 2011
- The Minerals, Metals and Materials Society (TMS)
  - Member 1993–2003
  - Professional Engineering Examination Committee, 1994–2006
- National Aerospace Standards Committee (NASC)
  - Technical Advisor 1994–2004