Craig A. Brice
757-310-3479
craigabrice@gmail.com

PROFESSIONAL PROFILE

Internationally recognized expert in the field of additive manufacturing with specific expertise in process control, alloy development, and qualification/certification. Worked hands-on with the very first commercially-available additive manufacturing system and was a key team member of the first industrial metal additive manufacturing research and development facility. Co-led one of the first qualification programs for additive manufactured parts in the aerospace community.

EXPERIENCE

Colorado School of Mines, Golden, CO June 2018 to present
Professor of Practice, Department of Mechanical Engineering
Director, Advanced Manufacturing Program

- Helped establish a new degree program in advanced manufacturing with a focus on additive manufacturing of structural materials.
  - Led curriculum development for degree offerings along with creation of a teaching laboratory for hands-on instruction in the field of additive manufacturing.
- Supported industrial engagement within the Alliance for the Development of Additive Manufacturing Technologies (ADAPT).
- Conducted research into additive manufacturing techniques, process control methods, and alloy development strategies.
  - Provided key leadership in the capture and execution of a $12.7M project targeting advanced sensing and control for rapid qualification of titanium additive components.

Lockheed Martin Space, Littleton, CO May 2015 to June 2018
Senior Staff Research Scientist, Advanced Technology Center

- Developed novel materials and manufacturing processes for spaceflight applications.
  - Assisted with qualification and certification for structural components.
  - Led multiple external cooperative research programs with international partnerships.
- Provided technical guidance to company leadership in the area of advanced manufacturing.
  - Developed business case justifications for resource investments and created implementation paths for advanced technology transition.

National Aeronautics and Space Administration, Hampton, VA Aug 2010 to May 2015
Senior Materials Research Engineer, Langley Research Center

- Developed additive manufacturing materials and processes for air and space vehicle structural applications.
  - Led multi-disciplinary team in research and development of structurally optimized gradient alloy components fabricated using additive manufacturing.
  - Developed novel alloy compositions specifically for additive manufacturing process that result in optimized performance.
  - Worked to establish process-microstructure-property relationships in a variety of alloys for a

variety of additive manufacturing processes.
  - Explored residual stress/distortion development in additively manufactured structures using high energy neutron/x-ray beam sources.
  - Established qualification and certification methodologies for additive manufacturing.
- Technical adviser on numerous external research activities with a variety of small businesses and academic partners.
- Organized and led a government interagency working group for additive manufacturing to establish cross-collaboration and coordinated accelerated development.
- Served as an additive manufacturing subject matter expert adviser to a variety of national manufacturing initiatives including America Makes.

Lockheed Martin Aeronautics Company, Fort Worth, TX *June 1999 to Aug 2010*
Materials Engineer Staff, Advanced Development Programs
Staff Materials Research Engineer, Advanced Development Programs

- Led metallic material research and development activities within the Materials and Manufacturing Exploration Laboratory.
  - Managed multiple concurrent projects, both internally and externally funded, with a total annual budget between $500K and $2.5M. Demonstrated success at securing external competitive funding streams to leverage existing work.
  - Utilized novel advanced manufacturing techniques to create unique alloy configurations with targeted properties. Has resulted in a number of patented material compositions with applications ranging from high temperature structure, lightweight armor, and wear resistant surfaces.
  - Conducted thorough microstructural characterization and analysis and developed testing procedures for validation of experimental materials.
- Developed advanced additive manufacturing processes for metallic materials. Demonstrated techniques, validated material characteristics, and weighed economic factors for a variety of processing methods.
  - Technical team lead for electron beam direct manufacturing implementation project for the F-35 Program. Developed technical transition plan for the establishment of a supplier base for a new manufacturing method.
  - Led closed-loop process control development activities, in close collaboration with vendor, for wire-fed electron beam additive manufacturing process.
- Organized and executed collaborative programs with government laboratories, private research organizations, and university participants, both domestic and international.

EDUCATION

University of Canterbury, Christchurch, New Zealand
Ph.D. Mechanical Engineering
Thesis: *Compositional sensitivity in additively manufactured aluminum alloy 2139*

The Ohio State University, Columbus, Ohio
M.S. Materials Science & Engineering
Thesis: *Dispersion strengthened titanium alloys produced via direct laser deposition*

Missouri University of Science and Technology, Rolla, Missouri
B.S. Metallurgical Engineering

PUBLICATIONS

Brice, C. A., Tayon, W. A., Newman, J. A., Kral, M. V., Bishop, C., & Sokolova, A. (2018). Effect of compositional changes on microstructure in additively manufactured aluminum alloy 2139. *Materials Characterization* (in press).

Yu, P., Yan, M., Tomus, D., Brice, C. A., Bettles, C. J., Muddle, B., & Qian, M. (2017). Microstructural development of electron beam processed Al-3Ti-1Sc alloy under different electron beam scanning speeds. *Materials Characterization* (in press).

Butler, T. M., Brice, C. A., Tayon, W. A., Semiatin, S. L., & Pilchak, A. L. (2017). Evolution of Texture from a Single Crystal Ti-6Al-4V Substrate During Electron Beam Directed Energy Deposition. *Metallurgical and Materials Transactions A*, 48(10), 4441-4446.

Li, X., Tang, W., Reynolds, A. P., Tayon, W. A., & Brice, C. A. (2016). Strain and texture in friction extrusion of aluminum wire. *Journal of Materials Processing Technology*, 229, 191-198.

Lundbäck, A., Pederson, R., Colliander, M. H., Brice, C., Steuwer, A., Heralic, A., ... & Lindgren, L. E. (2016). Modeling and Experimental Measurement with Synchrotron Radiation of Residual Stresses in Laser Metal Deposited Ti-6Al-4V. In *Proceedings of the 13th World Conference on Titanium* (pp. 1279-1282). John Wiley & Sons, Inc.

Brice, C., Shenoy, R., Kral, M., & Buchannan, K. (2015). Precipitation behavior of aluminum alloy 2139 fabricated using additive manufacturing. *Materials Science and Engineering: A*, 648, 9-14.

Brice, C. A., & Dennis, N. (2015). Cooling rate determination in additively manufactured aluminum alloy 2219. *Metallurgical and Materials Transactions A*, 46(5), 2304-2308.

Lundbäck, A., Pederson, R., Hörnqvist, M., Brice, C., Steuwer, A., Heralic, A., ... & Lindgren, L. E. (2015). Modelling and Simulation of Metal Deposition on a Ti-6Al-4V Plate. In *National Congress on Computational Mechanics*: 26/07/2015-30/07/2015.

Brice, C. A., Newman, J. A., Bird, R. K., Shenoy, R. N., Baughman, J. M., & Gupta, V. K. (2014). Electron beam freeform fabrication of titanium alloy gradient structures. *NASA/TM-2014-218508.*

Brice, C. A., & Hofmeister, W. H. (2013). Determination of bulk residual stresses in electron beam additive-manufactured aluminum. *Metallurgical and Materials Transactions A*, 44(11), 5147-5153.

Watkins, T., Bilheux, H., An, K., Payzant, A., Dehoff, R., Duty, C., ... & Brice, C. A. (2013). Neutron characterization for additive manufacturing. *Advanced Materials*, 171(3), 17-23.

Bush, R. W., & Brice, C. A. (2012). Elevated temperature characterization of electron beam freeform fabricated Ti–6Al–4V and dispersion strengthened Ti–8Al–1Er. *Materials Science and Engineering: A*, 554, 12-21.

Kral, M., Buchanan, K., Brice, C., Domack, M., Shenoy, R., & Hofmeister, W. (2012). Characterization of Electron Beam Deposited Aluminum Alloy 2139. In *AIP Conference Proceedings*. American Institute of Physics, Ste. 1 NO 1 Melville NY 11747-4502 United States.

Brice, C. A. (2011). Unintended consequences: How qualification constrains innovation. In *Proceedings of the 1st World Congress on Integrated Computational Materials Engineering (ICME)* (p. 241). John Wiley & Sons.

Brice, C. (2011). Net shape processing of titanium alloys for enhanced performance and improved affordability. In *Proceedings of the 12th World Conference on Titanium*, L. Zhou, H. Chang, Y. Lu, D. Xu, Beijin, The Nonferrous Metals Society of China (pp. 1697-1703).

Tomus, D., Qian, M., Brice, C. A., & Muddle, B. C. (2010). Electron beam processing of Al–2Sc alloy for enhanced precipitation hardening. *Scripta Materialia*, 63(2), 151-154.

Tomus, D., Qian, M., Yu, P., Brice, C. A., Bettles, C. J., & Muddle, B. C. (2010). Microstructural characteristics of electron beam processed Al-2Sc. In *Materials Science Forum* (Vol. 654, pp. 910-913). Trans Tech Publications.

Brice, C. A., Rosenberger, B. T., Sankaran, S. N., Taminger, K. M., Woods, B., & Nasserrafi, R. (2009). Chemistry control in electron beam deposited titanium alloys. In *Materials Science Forum* (Vol. 618, pp. 155-158). Trans Tech Publications.

Yu, P., Qian, M., Tomus, D., Brice, C.A., Schaffer, G.B., Muddle, B.C., “Electron Beam Processing of Aluminum Alloys”, *Materials Science Forum* 618-619 (2009) 621.

Brice, C.A. (2007). Nitride Strengthened Titanium via Deposition Processing. In *Proceedings of the 11th World Conference on Titanium*, Kyoto, Japan.

Brice, C., Barnes, J., & Taminger, K. (2005). Fabrication of titanium aerospace components via electron beam freeform fabrication. *Advanced Materials and Processes*, 163(4), 32-41.

Banerjee, R., Brice, C. A., Banerjee, S., & Fraser, H. L. (2003). Microstructural evolution in laser deposited Ni–25at.% Mo alloy. *Materials Science and Engineering: A*, 347(1), 1-4.

Brice, C. A., & Fraser, H. L. (2003). Characterization of Ti-Al-Er alloy produced via direct laser deposition. *Journal of materials science*, *38*(7), 1517-1521.

Brice, C. A., Henn, D. S., Siedal, D., Lachenberg, K., & Salo, R. (2002). Rapid prototyping and freeform fabrication via electron beam welding deposition. In *Proceeding of International Institute of Welding Conference*. Copenhagen, Denmark.

Schwendner, K. I., Banerjee, R., Collins, P. C., Brice, C. A., & Fraser, H. L. (2001). Direct laser deposition of alloys from elemental powder blends. *Scripta Materialia*, *45*(10), 1123-1129.

Zhang, X. D., Zhang, H., Grylls, R. J., Lienert, T. J., Brice, C., Fraser, H. L., ... & Schlienger, M. E. (2001). Laser-deposited advanced materials. *Journal of advanced materials*, *33*(1), 17-23.

Brice, C. A., Schwendner, K. I., Amancherla, S., Fraser, H. L., & Zhang, X. D. (2000). Characterization of laser deposited niobium and molybdenum silicides. *MRS Online Proceedings*, *625*.

Brice, C. A., Schwendner, K. I., Mahaffey, D. W., Moore, E. H., & Fraser, H. L. (1999, August). Process variable effects on laser deposited Ti-6Al-4V. In *Solid Freeform Fabrication Proceedings* (pp. 9-11). Austin, TX.

Zhang, X. D., Brice, C., Grylls, R. J., Evans, D. J., & Fraser, H. L. (1998). Characterization of laser-deposited TiAl alloys. *MRS Online Proceedings*, *552*.

PATENTS

Brice, C.A. (2017). U.S. *Patent No. 9,764,386, Functionally graded metal-metal composite structures*. Washington D.C: U.S. Patent and Trademark Office.

Brice, C.A. and Capshaw, W. (2014). *U.S. Patent No. 8,685,501, Co-continuous metal-metal matrix composite material using timed deposition processing*. Washington D.C: U.S. Patent and Trademark Office.

Brice, C.A. and Rosenberger, B.T. (2013). *U.S. Patent No. 8,389,072, System, method, and apparatus for variable hardness gradient armor alloys*. Washington D.C: U.S. Patent and Trademark Office.

Brice, C.A. (2012). *U.S. Patent No. 8,261,961, Metal matrix carbon nanotube composite material and method of making same*. Washington D.C: U.S. Patent and Trademark Office.

Rosenberger, B.T., Brice, C.A., Gardner, S.H., Weber, N.L. (2012). *U.S. Patent No. 8,215,222, System, method, and apparatus for improving the performance of ceramic armor materials with shape memory alloys*. Washington D.C: U.S. Patent and Trademark Office.

Brice, C.A. and Rosenberger, B.T. (2011). *U.S. Patent No. 7,871,041, System, method, and apparatus for leading edge structures and direct manufacturing thereof*. Washington D.C: U.S. Patent and Trademark Office.

Brice, C.A., Rosenberger, B.T., Gardner, S.H., Weber, N.L. (2010). *U.S. Patent No. 7,837,086, System, method, and apparatus for forming ballistic armor from ceramic and shape memory metallic alloy materials*. Washington D.C: U.S. Patent and Trademark Office.

Brice, C.A. and Herman, F.J. (2010). *U.S. Patent No. 7,758,776, Rapid Manufacture of carbon nanotube composite structure*. Washington D.C: U.S. Patent and Trademark Office.

Brice, C.A. (2006). *U.S. Patent No. 7,032,644, High Strength Aluminum Alloy and Method of Producing Same*. Washington D.C: U.S. Patent and Trademark Office.

Brice, C.A. and Herman, F.J. (2005). *U.S. Patent No. 6,949,216, Rapid Manufacture of Carbon Nanotubes Composite Structures*. Washington D.C: U.S. Patent and Trademark Office.

Brice, C.A. (2005). *U.S. Patent No. 6,932,865, Single Crystal Structures Through Freeform Fabrication Techniques*. Washington D.C: U.S. Patent and Trademark Office.