

# Jeffrey R. Bunn, Ph.D.

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## Experience

Jan 2017- Present      Oak Ridge National Lab      Oak Ridge, TN  
Neutron Instrument Scientist

- Lead Instrument Scientist and Point of Contact for the residual stress diffractometer at HFIR (HIDRA)
- Lead the successful proposal and funding of CrESL LDRD
- Mentored summer students and GO! Student (Robert Minneci)
- Working with INL as part of LDRD exploring Spark Plasma Sintering and will mentor a student at ORNL from RPI as part of project
- Lead the NRSF2 instrument upgrade project (~\$1million), to create the new world-class HIDRA instrument
- Leading researcher in measurement of residual stresses in complex sonification processes such as welding and well as additive manufacturing.

Aug 2014 - Dec 2016      Oak Ridge National Lab      Oak Ridge, TN  
Postdoctoral Research Associate

- Engineering materials group, Neutron sciences directorate
- Extensively supported user activity at engineering diffractometer at HFIR (NRSF2) – Mapping of residual stresses in engineering components
- Conducted independent scientific research in engineering materials
  - ❖ Engineering Diffraction
  - ❖ Neutron Imaging / X-ray Imaging
  - ❖ Small Angle Neutron Scattering

Fall 2007 – Spring 2014      University of Tennessee      Knoxville, TN  
Graduate Research Assistant

- Experience in neutron and x-ray imaging and scattering techniques
- Research is centered around neutron scattering techniques as used in studying of complex loading *in situ*
- Highly experienced in the acquisition and analysis of both neutron and x-ray imaging for use in characterization of Hydrogen Fuel Cells (NSF Fellowship)

## Education

2003-2007      University of Tennessee at Martin      Martin, TN  
B.S. in Engineering, Cum Laude

2007-2014      University of Tennessee      Knoxville, TN  
Ph.D. in Civil Engineering

## Honors

- Invited talk at PRCIM9 meeting in Kyoto, Japan to discuss residual stress measurement using neutrons as part of the Materials Characterization and Evaluation session.
- Appointed to ASM international Emerging Professionals Committee
- A.F. Davis Silver Medal for the most outstanding paper in the Welding Journal (2017)
- A.F. Davis Silver Medal for the most outstanding paper in the Welding Journal (2019)
- A.F. Davis Silver Medal for the most outstanding paper in the Welding Journal (2021)

## Special Skills

- Published peer-reviewed articles in the areas of non-destructive characterization of engineering materials using x-rays and neutrons
- Nearly 10 years of experience working in a laboratory setting performing non-destructive evaluation
- Expert in use of neutron and x-ray diffraction for the purpose of residual stress measurements
- Expert in use of neutron and x-ray imaging (both polychromatic and energy selective) for characterization
- Worked extensively with industrial users to obtain useful data for use in design
- Demonstrated ability to effectively communicate scientific output, even to non-scientific
- Demonstrated ability to work interdependently within a scientific group with various interests and specialties
- Programming and data reduction expertise with Excel, MATLAB and python
- Specific techniques of which I am proficient: XRD, SAXS, CT-Imaging (neutron and x-ray), SANS, Radiography (neutron and x-ray)

## *Publications List*

1. **Bunn, J. R.**, Fancher, C. M., Payzant, E. A., Cornwell, P. A., Bailey, W. B., & Gregory, R. (2023). The high intensity diffractometer for residual stress analysis (HIDRA), a third generation residual stress mapping neutron diffractometer at the high flux isotope reactor. *Review of Scientific Instruments*, 94(3), 035101. doi:10.1063/5.0122250
2. Yang, Y., Han, D., Gao, Y., Zhang, W., **Bunn, J. R.**, Payzant, E. A., . . . Feng, Z. (2022). Residual Stress Modeling and Advanced Diffraction Measurements of 347H Steel Weldments. Paper presented at the ASME 2022 Pressure Vessels & Piping Conference.
3. Abusalma, H., Eisazadeh, H., Hejripour, F., **Bunn, J.**, & Aidun, D. K. (2022). Parametric study of residual stress formation in Wire and Arc Additive Manufacturing. *Journal of Manufacturing Processes*, 75, 863-876. doi:https://doi.org/10.1016/j.jmapro.2022.01.043
4. Fancher, C. M., **Bunn, J. R.**, Bilheux, J., Zhou, W., Whitfield, R. E., Borreguero, J., & Peterson, P. F. (2021). pyRS: a user-friendly package for the reduction and analysis of neutron diffraction data measured at the High Intensity Diffractometer for Residual Stress Analysis. *Journal of Applied Crystallography*, 54(6), 1886-1893. doi:doi:10.1107/S1600576721010554
5. Watkins, T. R., Unocic, K. A., Peralta, A., Megahed, M., **Bunn, J. R.**, Fancher, C. M., . . . Neumann, J. F. (2021). Residual stresses and microstructure within Allvac 718Plus laser powder bed fusion bars. *Additive Manufacturing*, 47, 102334. doi:https://doi.org/10.1016/j.addma.2021.102334
6. Peterson, N. E., Einhorn, J. R., Fancher, C. M., **Bunn, J. R.**, Payzant, E. A., & Agnew, S. R. (2021). Quantitative texture analysis using the NOMAD time-of-flight neutron diffractometer. *Journal of Applied Crystallography*, 54(3), 867-877. doi:doi:10.1107/S1600576721003022
7. Ryan, S., Gallardy, D., Zellner, M., **Bunn, J.**, Nguyen, L., & Swoboda, P. (2021). Investigating the relationship between radial pre-stress magnitude and ballistic projectile dwell in heavy confined ceramic targets. *International Journal of Impact Engineering*, 157, 104002. doi:https://doi.org/10.1016/j.ijimpeng.2021.104002
8. Peterson, N. E., Einhorn, J. R., Fancher, C. M., **Bunn, J. R.**, Payzant, E. A., & Agnew, S. R. (2021). Quantitative texture analysis using the NOMAD time-of-flight neutron diffractometer. *Journal of Applied Crystallography*, 54(3), 867-877.
9. Nycz, A., Lee, Y., Noakes, M., Ankit, D., Masuo, C., Simunovic, S., **Bunn J.** . . . Fancher, C. (2021). Effective Residual Stress Prediction Validated with Neutron Diffraction Method for Metal Large-Scale Additive Manufacturing. *Materials & Design*, 109751. doi:https://doi.org/10.1016/j.matdes.2021.109751
10. Sridharan, N., **Bunn, J.**, Kottman, M., Fancher, C. M., Payzant, A., Noakes, M., . . . Babu, S. (2021). Consumable development to tailor residual stress in parts fabricated using directed energy deposition processes. *Additive Manufacturing*, 39, 101837.
11. Nicholson, D. E., Padula, S. A., Benafan, O., **Bunn, J. R.**, Payzant, E. A., An, K., . . . Vaidyanathan, R. (2021). Mapping of Texture and Phase Fractions in Heterogeneous Stress States during Multiaxial Loading of Biomedical Superelastic NiTi. *Advanced Materials*, 33(5), 2005092.
12. Chatzidakis, S., Tang, W., Miller, R., Payzant, A., **Bunn, J.**, Bryan, C., . . . Wang, J.-A. (2021). Neutron diffraction illustrates residual stress behavior of welded alloys used as radioactive confinement boundary. *International Journal of Pressure Vessels and Piping*, 191, 104348.
13. Wu, X., Wang, Z., Yu, Z., Liu, S., **Bunn, J. R.**, Kolbus, L., & Feng, Z. (2020). Control of Weld Residual Stress in a Thin Steel Plate through Low Transformation Temperature Welding Consumables. *Welding Journal*, 99(4).

14. Pajerowski, D. M., Ng, R., Peterson, N., Zhang, Y., Stone, M. B., Dos Santos, A. M., . . . Fanelli, V. (2020). 3D scanning and 3D printing AlSi10Mg single crystal mounts for neutron scattering. *Review of Scientific Instruments*, 91(5), 053902.
15. Noyan, I. C., **Bunn, J. R.**, Tippett, M., Payzant, E., Clausen, B., & Brown, D. W. (2020). Experimental determination of precision, resolution, accuracy and trueness of time-of-flight neutron diffraction strain measurements. *Journal of Applied Crystallography*, 53(2), 494-511.
16. Minneci, R. P., Lass, E. A., **Bunn, J. R.**, Choo, H., & Rawn, C. J. (2020). Copper-based alloys for structural high-heat-flux applications: a review of development, properties, and performance of Cu-rich Cu–Cr–Nb alloys. *International Materials Reviews*, 1-32.
17. Liu, T., Vaudin, M. D., **Bunn, J. R.**, Ungár, T., & Brewer, L. N. (2020). Quantifying dislocation density in Al-Cu coatings produced by cold spray deposition. *Acta Materialia*, 193, 115-124.
18. Liu, T., **Bunn, J. R.**, Fancher, C. M., Nastac, L., Arvikar, V., Levin, I., & Brewer, L. N. (2020). Neutron Diffraction Analysis of Residual Strain in High-Pressure Die Cast A383 Engine Blocks. *Journal of Materials Engineering and Performance*, 29(8), 5428-5434.
19. Bedekar, V., Voothaluru, R., **Bunn, J.**, & Hyde, R. S. (2019). Measurement and prediction of through-section residual stresses in the manufacturing sequence of bearing components. *CIRP Annals*. <https://doi.org/10.1016/j.cirp.2019.03.004>
20. Chatzidakis, S., Tang, W., Chen, J., Miller, R. G., Payzant, A., **Bunn, J. R.**, & Wang, J.-A. J. (2019). *Neutron Residual Stress Mapping of Repaired Spent Nuclear Fuel Welded Stainless-Steel Canisters*. Paper presented at the Conference: IHLRWM 2019 - Knoxville, Tennessee, United States of America.
21. Fancher, C. M., Hoffmann, C. M., Frontzek, M. D., **Bunn, J. R.**, & Payzant, E. A. (2019). Probing orientation information using 3-dimensional reciprocal space volume analysis. *Review of Scientific Instruments*, 90(1), 013902. doi:10.1063/1.5034135
22. Cornwell, P., **Bunn, J.**, Fancher, C. M., Payzant, E. A., & Hubbard, C. R. (2018). Current capabilities of the residual stress diffractometer at the high flux isotope reactor. *Review of Scientific Instruments*, 89(9), 092804. doi:10.1063/1.5037593
23. Eisazadeh, H., Payzant, E. A., Cornwell, P. A., **Bunn, J. R.**, & Aidun, D. K. (2018). Exploring the Cooling Process for Residual Stress Reduction in Dissimilar Welds. *Welding Journal*, 97(11), 315S-325S. doi:10.29391/2018.97.027
24. Ikeda, T., **Bunn, J.**, Fancher, C., Seid, A., Motani, R., Matsuda, H., & Okayama, T. (2018). Non-Destructive Measurement of Residual Strain in Connecting Rods Using Neutrons. <https://doi.org/10.4271/2018-01-1063>
25. Kemerling, B., Lippold, J. C., Fancher, C. M., & **Bunn, J.** (2018). Residual stress evaluation of components produced via direct metal laser sintering. *Welding in the World*, 62(3), 663-674. doi:10.1007/s40194-018-0572-z
26. Moraes, J. F. C., Jordon, J. B., Su, X., Brewer, L. N., Fay, B. J., **Bunn, J. R.**, . . . Barkey, M. E. (2018). Residual Stresses and Plastic Deformation in Self-Pierce Riveting of Dissimilar Aluminum-to-Magnesium Alloys: SAE International.
27. Wang, J.-A. J., Payzant, A., **Bunn, J. R.**, & An, K. (2018). Neutron Residual Stress Mapping for Spent Nuclear Fuel Storage Canister Weldment (ORNL/TM-2018/827 United States 10.2172/1435212 ORNL English). Retrieved from <https://www.osti.gov/servlets/purl/1435212>
28. Xinghua, Y., Demetrios, T., **Jeff, B.**, Andrew, P. E., & Zhili, F. (2017). Tensile Residual Stress Mitigation Using Low Temperature Phase Transformation Filler Wire in Welded Armor Plates Residual Stresses 2016: ICRS-10 (Vol. 2, pp. 461-466).
29. Steiner, M. A., **Bunn, J. R.**, Einhorn, J. R., Garlea, E., Payzant, E. A., & Agnew, S. R. (2017). Path length dependent neutron diffraction peak shifts observed during residual strain measurements in U-8 wt% Mo castings. *Journal of Applied Crystallography*, 50, 851-858. doi:10.1107/S1600576717005295

30. Pupilampu, S. B., Penumadu, D., Ma, R., Truster, T. J., Woracek, R., Payzant, E. A., & **Bunn, J. R.** (2017). Degradation and onset of plastic anisotropy in marine aluminum alloy due to fire exposure by bulk neutron diffraction and in situ loading. *Materials Science and Engineering a-Structural Materials Properties Microstructure and Processing*, 700, 583-591. doi:10.1016/j.msea.2017.06.050
31. Hempel, N., **Bunn, J.R.**, et al. (2017). "Study on the residual stress relaxation in girth-welded steel pipes under bending load using diffraction methods." *Materials Science and Engineering: A* **688**: 289-300.
32. N. Hempel, **J.R. Bunn**, T. Nitschke-Pagel, E.A. Payzant, K. Dilger, 'Residual Stress Analysis in Girth-welded Ferritic and Austenitic Steel Pipes Using Neutron and X-Ray Diffraction', *Materials Research Proceedings*, Vol. 2, pp 229-234, 2017
33. X. YU, D. TZELEPIS, **J. BUNN**, A.E. PAYZANT, Z. FENG, 'Tensile Residual Stress Mitigation Using Low Temperature Phase Transformation Filler Wire in Welded Armor Plates', *Materials Research Proceedings*, Vol. 2, pp 461-466, 2017
34. H. Eisazadeh, **J. Bunn**, and D. K. Aidun, "Numerical and Experimental Investigation of Residual Stress Distribution in a Dissimilar Ferritic-Austenitic Weld", *Welding Journal*, vol.96, no.1, p.21-s (January 2017)
35. Eisazadeh, H., **Bunn, J.R.**, et al. (2016). "A Residual Stress Study in Similar and Dissimilar Welds" *Welding Journal* 95(4).
36. Penumadu, D., Kim, F.S., **Bunn, J.R.** (2016). "Damage of Composite Materials Subjected to Projectile Penetration Using High Resolution X-Ray Micro Computed Tomography." *Experimental Mechanics* 56(4): 607-616.
37. Cakmak, E., Watkins, T.R., **Bunn, J.R.**, et al (2016). "Mechanical Characterization of an Additively Manufactured Inconel 718 Theta-Shaped Specimen." *Metallurgical and Materials Transactions a-Physical Metallurgy and Materials Science* 47A(2): 971-980.
38. S. D. Bagg, L. M. Sochalski-Kolbus, **J. R. Bunn**, (2016) "The Effect of Laser Scan Strategy on Distortion and Residual Stresses of Arches Made With Selective Laser Melting." in American Society of Precision Engineering (ASPE) 2016 Summer Topical Meeting: Dimensional Accuracy and Surface Finish in Additive Manufacturing; 27-30 Jun. 2016.
39. **Bunn, J. R.**, et al. (2014). "Effect of Multi-Axial Loading on Residual Strain Tensor for 12L14 Steel Alloy." *Metallurgical and Materials Transactions a-Physical Metallurgy and Materials Science* 45A(9): 3806-3813.
40. **Bunn, J. R.** (2014). Neutron Diffraction Study of Engineering Materials Subjected to Complex Loadings. *Civil and Environmental Engineering*, University of Tennessee. Doctor of Philosophy.
41. Woracek, R., **Bunn, J.R.**, et al. (2013). "Methodology for Combined Neutron Diffraction and Bragg Edge Imaging." *MRS Proceedings* 1528: mrsf12-1528-vv1508-1504.
42. **Bunn, J. R.**, et al. (2013). "Detection of water with high sensitivity to study polymer electrolyte fuel cell membranes using cold neutrons at high spatial resolution." *Applied Physics Letters* 102(23).
43. Woracek, R., **Bunn, J.R.**, et al. (2012). "New Approach to Measure Lattice Strains under Torsional Shear Using In Situ Neutron Diffraction for Polycrystalline Materials." *AIP Conference Proceedings*.
44. Woracek, R., **Bunn, J.R.**, et al. (2012). "Method to determine hkl strains and shear moduli under torsion using neutron diffraction." *Applied Physics Letters* 100(19).
45. Kim, F., et al. (2011). Three Dimensional Microstructure of Polymeric Composite Materials Used in Sandwich Structures Using Dual Modality From Combined High Resolution X-ray and Neutron Tomography. *18th International Conference on Composites Materials (ICCM)*.
46. **Bunn, J.**, et al. (2010). "Residual strain evolution in steel samples: tension versus torsion." *Applied Physics A* 99(3): 571-578.
47. LeMaster, R., et al. (2009). "In-Situ Measurement of Stresses in Carburized Gears via Neutron Diffraction." *Gear Technology* 26(3): 38-43.

48. Lemaster, R. A., et al. (2009). "Grinding Induced Changes in Residual Stresses of Carburized Gears." Gear Technology 26(2): 42-49.