

## **Benjamin T. Manard, PhD**

R&D Staff Scientist – Analytical Chemist  
Chemical & Isotopic Mass Spectrometry Group  
Chemical Sciences Division  
Oak Ridge National Laboratory

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**Department of Energy Q-Clearance (active since August 2014)**

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### **EDUCATION**

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**Clemson University, Clemson, SC** **May 2014**  
Ph.D. in Analytical Chemistry

**Georgia Southern University, Statesboro, GA** **May 2009**  
B.S. in Chemistry

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### **RESEARCH EXPERIENCE**

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**Senior R&D Staff** **2024 - present**  
Group Leader – Chemical & Isotopic Mass Spectrometry Group  
Oak Ridge National Laboratory, Oak Ridge, TN  
Research area: Development and implementation of advanced analytical atomic spectroscopy and mass spectrometric instrumentation (ICP-OES/MS) for the analysis of materials.

**R&D Staff Scientist – Analytical Chemist** **2018 - 2024**  
Oak Ridge National Laboratory, Oak Ridge, TN  
*Nuclear Analytical Chemistry and Isotopics Laboratory*  
Research area: Development and implementation of atomic spectroscopy and mass spectrometric instrumentation (ICP-OES/MS) for the analysis of nuclear materials for elemental and isotopic information.

**Scientist II** **2016 – 2018**  
Los Alamos National Laboratory, Los Alamos, NM  
Chemistry-Actinide Analytical Chemistry Group  
Research area: Development of miniaturized separation/sample preparation methods for trace metal analysis and impurities of bulk nuclear materials. Trace elemental analysis in bulk actinide materials (plutonium and uranium) by inductively coupled plasma mass spectrometry / optical

emission spectroscopy. Pu-238 trace metal analysis for NASA related projects by direct current arc spectroscopy.

**Glenn T. Seaborg Postdoctoral Fellow**

**2014—2016**

Los Alamos National Laboratory, Los Alamos, NM

Chemistry-Actinide Analytical Chemistry Group

Research area: Development of miniaturized separation/sample preparation methods for trace metal analysis and impurities of bulk nuclear materials.

Research Mentor: **Ning Xu**

Research Co-Mentor: **Alonso Castro**

**Graduate Research Assistant**

**2009—2014**

Clemson University, Clemson, SC

Department of Chemistry

Research area: Miniaturization of chemical analysis tools: micro-solid phase extraction tips for protein extractions and development of a miniaturized glow discharge source for elemental analysis.

Research Advisor: **R. Kenneth Marcus**

**Visiting Scientist**

**2014**

Pacific Northwest National Laboratory, Richland, WA

Environmental Molecular Sciences Laboratory

Research area: Miniaturization of a microplasma ionization source for elemental isotopic analysis by mass spectrometry.

Research Mentor(s): **Dave Koppelaar**

**Visiting Scientist**

**2013**

Lawrence Berkeley National Laboratory, Berkeley, CA

Environmental Energy Technologies

Research area: Laser ablation studies into the liquid sampling-atmospheric pressure glow discharge, particularly understanding fundamental plasma properties.

Research Mentor: **Richard E. Russo**

**Undergraduate Research Assistant**

**2007—2009**

Georgia Southern University, Statesboro, GA

Research area: Improvement of iron zeolites employment for adipic acid production.

Research Advisor: **L. Shannon Davis**

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## OTHER WORK

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Georgia Southern Chemistry Department

2008—2009

Statesboro, GA

Analytical Chemistry / Instrumental Analysis Assistant: instrumentation maintenance, calibration, and performance testing.

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## PEER REVIEWED PUBLICATIONS (\* denotes first or corresponding author 29/62)

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62. N.A. Zirakparvar, **B.T. Manard**, M. Darnell, D.R. Dunlap, C.R. Hexel, S.C. Metzger, B.W. Ticknor, “**Exploration of metallic interferences pertinent to nuclear safeguards related uranium isotopic radio measurement on the Neoma MC-ICP-MS platform without the MS/MS option**”, Accepted for publication in *Int. J. Mass. Spectrom.*, **2024**.

61. N.A. Zirakparvar, **B.T. Manard**, D.R. Dunlap, C.R. Hexel, “**A preliminary investigation into the feasibility for laser ablation U-Pb isotope ratio measurements via all Faraday cup detection with  $10^{11}$  &  $10^{13}$   $\Omega$  amplifiers on the Neoma MC-ICP-MS**”, Accepted for publication in *R. Commun. Mass Spectrom.*, **2024**.

\*60. **B.T. Manard**, C.D. Quarles Jr, V.C. Bradley, T.L. Spano, N.A. Zirakparvar, B.W. Ticknor, D.R. Dunlap, P. Cable-Dunlap, C.R. Hexel, H.B. Andrews, “**Uranium single particle analysis for simultaneous fluorine and uranium isotopic determinations via LIBS/LA-MC-ICP-MS**”, *J. Am. Chem.*, **2024**, 146, 14856-14863.

59. B.R. LaFreniere, B. Donahue, J.E. Price, A. Cruz-Uribe, N. Miller, **B.T. Manard**, R. McBride, J.A. Mohan, “**Chemical clocks: using otolith geochemistry to enhance estimation of age and growth of white hake (*Urophycis tenuis*)**” *Fish. Bull.* **2024**, 44-57.

\*58. V.C. Bradley, **B.T. Manard**, L. Hendriks, D.R. Dunlap, A.N. Bible, A. Sedova, P. Saint-Vincent, B.C. Sanders, H.B. Andrews, “**Quantifying platinum binding on protein-functionalized magnetic microparticles using single particle-ICP-TOF-MS**”, *Anal. Methods*, **2024**, 16, 3192-3201. **This article is highlighted on the cover.**

57. T.L. Spano, H.B. Andrews, A. Miskoweic, T.N. Beiswenger, **B.T. Manard**, “**Spatially Resolved Raman Spectroscopic Investigation of  $UO_2F_2$ : A Case Study in the Importance of Instrument Optimization**”, Accepted for publication in *Appl. Spectrosc.*, **2024**.

\*56. V.C. Bradley, J. Burleson, H.B. Andrews, C.V. Thompson, T.L. Spano, D.R. Dunlap, N.A. Zirakparvar, B.W. Ticknor, C.R. Hexel, **B.T. Manard**, “**Mapping of uranium particles on J-type swipe with microextraction-ICP-MS**” *Analyst*, **2024**, 149, 2244-2251. **This article is highlighted on the cover.**

55. T. Wang, H. Luo, Y. Bai, I. Belharourak, K. Jayanthi, M.P. Paranthaman, **B.T. Manard**, E.T. Wang, F. Dogan, S.B. Son, B.J. Ingram, Q. Dai, S. Dai, “**Direct recycling of spent nickel-rich cathodes in reciprocal ternary molten salts**” *J. Power Sources*, **2024**, 593, 15, 233798.

\*54. J. Goodwin, **B.T. Manard**, B.W. Ticknor, P. Cable-Dunlap, R. K. Marcus, “Investigation of potential polyatomic interferences on uranium isotope ratio measurements for the LS-APGD-Orbitrap MS system” *Microchem.*, **2024**, 196, 109645.

\*53. H.B. Andrews, C.D. Quarles, V.C. Bradley, T.L. Spano, J.A. Petrus, B. Paul, N.A. Zirakparvar, D.R. Dunlap, C.R. Hexel, **B.T. Manard**, “Advancing Elemental and Isotopic Analysis of Uranium Mineral Inclusions: Rapid Screening via Laser-Induced Breakdown Spectroscopy and High-Resolution Laser Ablation-ICP-MS Mapping” *Microchem.*, **2024**, 196, 109605.

52. T.L. Spano, T. Beiswenger, **B.T. Manard**, T.L. Ulrich, R. Hunt, A. Miskowiec, A.E. Shields, “Structural Features of Early Fuel Cycle Taggant Incorporation for Intentional Nuclear Forensics”, *J. Nucl. Mater.*, **2024**, 588, 154787.

51. K. Jayanthi, M.P. Paranthaman, **B.T. Manard**, A. Navrotsky, “Effect of Anions on Delithiation of [Li-Al] Layered Double Hydroxides: Thermodynamic Insights” *J. Phys. Chem. C.*, **2023**, 127, 49, 23879-23886.

\*50. V.C. Bradley, B.W. Ticknor, D.R. Dunlap, N.A. Zirakparvar, S.C. Metzger, C.R. Hexel, **B.T. Manard**, “Microextraction-TQ-ICP-MS for the Direct Analysis of U and Pu from Cotton Swipes”, *Anal. Chem.*, **2023**, 95, 43, 15867-15874. This article is highlighted on the cover.

49. N. A. Zirakparvar, **B.T. Manard**, S.C. Metzger, C.R. Hexel, D.A. Bostick, V.C. Bradley, B.W. Ticknor, “Review of Faraday detector uranium isotope ratio measurement: Insights from solution- and laser ablation- based sampling methodologies on Neoma MC-ICP-MS”, *Int. J. Mass Spectrom.*, **2023**, 492, 117114.

\*48. J. Goodwin, **B.T. Manard**, B.W. Ticknor, P. Cable-Dunlap, R. K. Marcus, “Initial Characterization and Optimization of the Liquid Sampling – Atmospheric Pressure Glow Discharge Ionization Source Coupled to an Orbitrap Mass Spectrometer for the Determination of Plutonium”, *Anal. Chem.*, **2023**, 95, 32, 12131-12138. This article is highlighted on the cover.

\*47. **B.T. Manard**, H.B. Andrews, C.D. Quarles, V.C. Bradley, P. Doyle, N.A. Zirakparvar, D.R. Dunlap, C.R. Hexel, “Exploration of LIBS as a Novel and Rapid Elemental Mapping Technique of Nuclear Fuels in the Form of Surrogate TRISO Particles”, *J. Anal. At. Spectrom.*, **2023**, 38, 1412-1420. This article is highlighted on the front cover.

46. J.V. Goodwin, **B.T. Manard**, B.W. Ticknor, K.T. Rogers, C.R. Hexel, P. Cable-Dunlap, R.K. Marcus, “Preliminary Investigation of an Uncertainty Budget for Uranium Isotope Ratio Analysis Using a Liquid Sampling – Atmospheric Pressure Glow Discharge / Orbitrap Mass Spectrometer System”, *J. Radioanal. Nucl.*, **2023**, 332, 2875-2886.

\*45. **B.T. Manard**, V.C. Bradley, C.D. Quarles, L. Hendriks, D.R. Dunlap, C.R. Hexel, P. Sullivan, H.B. Andrews, “Towards Automated and High-Throughput Quantitative Sizing and Isotopic Analysis of Nanoparticles via Single Particle-ICP-TOF-MS”, *Nanomaterials*, **2023**, 13(8), 1322. This article is highlighted on the front cover.

44. L. Sadergaski, **B.T. Manard**, H.B. Andrews, “**Analysis of Trace Elements in Uranium by Inductively Coupled Plasma – Optical Emission Spectroscopy, Design of Experiments, and Partial Least Squares Regression**”, *J. Anal. At. Spectrom.*, **2023**, 38, 800-809. This article is highlighted on the front, inside, cover.

43. J. Denton, D.A. Bostick, S.F. Boulyga, J.A. Cunningham, I. Dimayuga, C.R. Hexel, J. Hiess, S.V. Jovanovic, P. Kaye, T. Kell, F. Kelly, W. Kinman, S. Kiser, R.E. Lindvall, Z. Macsik, **B.T. Manard**, K. Mayer, J.F. Mercier, P. Samuleev, P.R.B. Saull, Y. Shi, R.E. Steiner, B.W. Ticknor, M. Totland, Z. Varga, M. Wallenius, E.M. Wylie, “**International Interlaboratory Compilation of Trace Element Concentrations in the CUP-2 Uranium Ore Concentrate Standard**”, *J. Radioanal. Nucl.*, **2023**, 332, 2817-2832.

\*42. V.C. Bradley, C.R. Hexel, T.L. Spano, C.V. Thompson, B.W. Ticknor, D.R. Dunlap, S.C. Metzger, **B.T. Manard**, “**Analysis of Solid Uranium Particulates on Cotton Swipes with an Automated Microextraction-ICP-MS System**”, *Anal. Methods*, **2022**, 14, 4466-4473. This article is highlighted on the front cover.

41. B.D. Roach, K.T. Rogers, N.A. Zirakparvar, J.S. Delashmitt, S.C. Metzger, **B.T. Manard**, T.J. Keever, J. M. Giaquinto, C.R. Hexel, “**Need for Speed- Burnup Determination of Spent Nuclear Fuel**”, *Talanta Open*, **2022**, 6, 100152.

\*40. **B.T. Manard**, C.J. Hintz, C.D. Quarles Jr., W. Burns, N.A. Zirakparvar, D.R. Dunlap, T. Beiswenger, A.M. Cruz-Uribe, J.A. Petrus, and C.R. Hexel, “**Determination of Fluorine Distribution in Shark Teeth by Laser Induced Breakdown Spectroscopy**” *Metallomics*, 14(6) **2022**.

39. N.A. Zirakparvar, **B.T. Manard**, C.R. Hexel, D. Dunlap, “**Investigation of the <sup>176</sup>Yb Interference Correction During Determination of the <sup>176</sup>Hf/<sup>177</sup>Hf Ratio by Laser Ablation and Solution Analysis on the Neoma MC-ICP-MS**”, *Minerals*, **2022**, 12, 882, 1-15.

\*38. V.C. Bradley, T.L. Spano, S.C. Metzger, B.W. Ticknor, D. Dunlap, N.A. Zirakparvar, B.D. Roach, C.R. Hexel, **B.T. Manard**, “**Direct Isotopic Analysis of Solid Uranium Particulates on Cotton Swipes by Microextraction-ICP-MS**”, *Anal. Chim. Acta*, **2022**, 1209, 339836.

37. J. Goodwin, **B.T. Manard**, B.W. Ticknor, P.C. Dunlap, R.K. Marcus, “**Improved Uranium Isotopic Ratio Determinations for the Liquid Sampling – Atmospheric Pressure Glow Discharge Orbitrap Mass Spectrometer by use of Moving Average Processing**”, *J. Anal. At. Spectrom.*, **2022**, 37, 814-822.

\*36. **B.T. Manard**, S.C. Metzger, K.T. Rogers, B.W. Ticknor, N.A. Zirakparvar, B.D. Roach, D.A. Bostick, C.R. Hexel, “**Direct Analysis of Cotton Swipes for Plutonium Isotope Determination by Microextraction-ICP-MS**”, *J. Anal. At. Spectrom.*, **2021**, 36, 10, 2202-2209.

\*35. **B.T. Manard**, K.T. Rogers, B.W. Ticknor, S.C. Metzger, N.A. Zirakparvar, B.D. Roach, D.A. Bostick, C.R. Hexel, “**Direct Uranium Isotopic Analysis of Swipe Surfaces by Microextraction-ICP-MS**”, *Anal. Chem.*, **2021**, 93, 32, 11133-11139. This article is highlighted on the front cover. Altmetric Attention Score of 57 (97<sup>th</sup> percentile of all outputs ever tracked by Altmetric)

34. S.C. Metzger, **B.T. Manard**, D.A. Bostick, B.W. Ticknor, K.T. Rogers, E.H. McBay, D. Glasgow, N.A. Zirakparvar, C.R. Hexel, **“An Approach to Separating U, Pu, and Ti from High-Purity Graphite for Isotopic Analysis by MC-ICP-MS”**, *J. Anal. At. Spectrom.*, **2021**, 36, 6, 1095-1314. **This article is highlighted on the cover.**

\*33. **B.T. Manard**, D.A. Bostick, S.C. Metzger, B.W. Ticknor, N.A. Zirakparvar, K.T. Rogers, C.R. Hexel, **“Rapid and Automated Separation of Uranium Ore Concentrates for Trace Element Analysis by ICP-OES/TQMS”**, *Spectrochim. Acta B*, **2021**, 179, 106097.

32. N. Fletcher, **B.T. Manard**, D.A. Bostick, W.D. Bostick, S.C. Metzger, B.W. Ticknor, K.T. Rogers, C.R. Hexel, **“Determination of Phosphorus and Sulfur in Uranium Ore Concentrates by Triple Quadrupole Inductively Coupled Plasma Mass Spectrometry”**, *Talanta*, **2021**, 221, 121573.

\*31. **B.T. Manard**, S.C. Metzger, S. Wysor, V. Bradley, N.A. Zirakparvar, K.T. Rogers, D.A. Bostick, B.W. Ticknor, C.R. Hexel, **“Trace Elemental Analysis of Bulk Thorium Using an Automated Separation – Inductively Coupled Plasma Optical Emission Spectroscopy Methodology”**, *Appl. Spectrosc.*, **2021**, 75, 5, 556-564.

\*30. **B.T. Manard**, S.C. Metzger, K.T. Rogers, B.W. Ticknor, D.A. Bostick, N.A. Zirakparvar, C.R. Hexel, **“Exploration of ICP Platforms for Measuring Elemental Impurities in Uranium Ore Concentrates”**, *Int. J. Mass Spectrom.*, **2020**, 455, 116378.

29. H.W. Paing, **B.T. Manard**, B.W. Ticknor, J.R. Bills, K.A. Hall, D.A. Bostick, P. Cable-Dunlap, R.K. Marcus, **“Rapid Determination of Uranium Isotopic Abundance from Cotton Swipes: Direct Extraction via a Planer Surface Reader and Coupling to a Microplasma Ionization Source”** *Anal. Chem.*, **2020**, 92, 12, 8591-8598.

28. A. Ronne, L. He, D. Dolzhenkov, Y. Xie, M. Ge, P. Halstenberg, Y. Wang, **B.T. Manard**, X. Xiao, W.K Lee, K. Sasaki, S. Dai, S. Mahurin, Y.C. Chen-Wiegart, **“Revealing 3D Morphological and Chemical Evolution Mechanisms of Metals in Molten Salt by Multimodal Microscopy”** *ACS Appl. Mater. Interfaces*, **2020**, 12(15), 17321-17333.

27. N. Fletcher, **B.T. Manard**, S.C. Metzger, B.W. Ticknor, D.A. Bostick, C.R. Hexel, **“Determining P, S, Br, and I Content in Uranium by Triple Quadrupole Inductively Coupled Plasma Mass Spectrometry”** *J. Radioanal. Nucl.*, **2020**, (324), 395-402.

\*26. V. Bradley, **B.T. Manard**, B.D. Roach, S.C. Metzger, K.T. Rogers, B.W. Ticknor, S. Wysor, J. Brockman, and C. Hexel, **“Rare Earth Element Determination in Uranium Ore Concentrates using Online and Offline Chromatography Coupled to ICP-MS”** *Minerals*, **2020**, 10(1), 1-11.

25. K.T. Bennett, S.A. Kozimor, **B.T. Manard**, V. Mocko, S.D. Pacheco, A.R. Schake, R. Wu, A.C. Olson, **“Rapid Activation Product Separations from Fission Products and Soil Matrixes”** *J. Radioanal. Nucl.*, **2019**, 322, 281-289.

\*24. **B.T. Manard**, C.D Quarles, S.C. Metzger, K.T. Rogers, B.W. Ticknor, D.A. Bostick, E.H. McBay, C.R. Hexel, **“The Evaluation and Specifications for In-Line Uranium Separations with ICP-OES Detection for Trace Elemental Analysis”** *Appl. Spectrosc.*, **2019**, 73, 927-935.

23. S.C. Metzger, K.T. Rogers, D.A. Bostick, E.H. McBay, B.W. Ticknor, **B.T. Manard**, C.R. Hexel, **“Optimization of Uranium and Plutonium Separations Using TEVA and UTEVA Cartridges for MC-ICP-MS Analysis for Environmental Swipe Samples”** *Talanta*, **2019**, 198, 257-262.

\*22. **B.T. Manard**, M.F. Schappert, E.M. Wylie, G.E. McMath, **“Investigation of Handheld Laser Induced Breakdown Spectroscopy (HH LIBS) for the Analysis of Beryllium on Swipe Surfaces”** *Anal. Methods*, **2019**, 11, 752-759.

21. C.D. Quarles, **B.T. Manard**, E.M. Wylie, N. Xu, **“Trace Elemental Analysis of Bulk Uranium Materials Using an In-Line Automated Sample Preparation Technique for ICP-OES”** *Talanta*, **2018**, 190, 460-465.

20. E.D. Hoegg, **B.T. Manard**, E.M. Wylie, K.J. Mathew, C.F. Ottenfeld, R.K. Marcus, **“Initial Benchmarking of the Liquid Sampling Atmospheric Pressure Glow Discharge – Orbitrap System Against Traditional Atomic Mass Spectrometry Techniques for Nuclear Applications”** *J. Am. Soc. Mass Spectrom.*, **2018**, 30, 278-288.

19. E.M. Wylie, **B.T. Manard**, C.D. Quarles, L. Meyers, N. Xu, **“An Automated, Miniaturized System for the Chromatographic Removal of Uranium Matrix for Trace Element Analysis by ICP-OES”** *Talanta*, **2018**, 189, 24-30.

\*18. **B.T. Manard**, E.M. Wylie, and S.P. Willson, **“Analysis of Rare Earth Elements in Uranium by Handheld Laser Induced Breakdown Spectroscopy (HH LIBS)”** *Appl. Spectrosc.*, **2018**, 72 1653-1660.

\*17. **B.T. Manard**, C. D. Quarles, E. M. Wylie, N. Xu, **“Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry / Laser Induced Breakdown Spectroscopy: a Tandem Technique for Uranium Particle Characterization”** *J. Anal. At. Spectrom.*, **2017**, 9, 1611-1822. This article is highlighted on the front cover of JAAS. This article is highlighted in JAAS as “Recent HOT articles”.

16. R. K. Marcus, **B.T. Manard**, C. D. Quarles, **“Liquid Sampling-Atmospheric Pressure Glow Discharge (LS-APGD) Microplasmas for Diverse Spectrochemical Analysis Applications”** *J. Anal. At. Spectrom.*, **2017**, 32, 706-716. This article is highlighted in JAAS as “Recent HOT articles”.

15. J. Gao, **B.T. Manard**, A. Castro, D. Montoya, N. Xu, R. Chamberlin, **“Solid-Phase Extraction Microfluidic Devices for Matrix Removal in Trace Element Assay of Actinide Materials”** *Talanta*, **2017**, 167, 8-13

\*14. **B.T. Manard**, J. Matonic, D. Montoya, R. Jump, A. Castro, N. Xu, **“Assessment of the Excitation Temperatures and the Mg II:I Line Ratios of the Direct Current (DC) Arc Source for the Analysis of Radioactive Materials”** *J. Radioanal. Nucl.*, **2017**, 312, 385-393.

13. D. Montoya, **B.T. Manard**, N. Xu, **“Novel Sample Introduction System to Reduce ICP-OES Sample Size for Plutonium Metal Trace Impurity Determination,”** *J. Radioanal. Nucl.*, **2016**, 307, 2009-2014

12. L.X. Zhang, **B.T. Manard**, B. Powell and R. K. Marcus, "Preliminary Assessment of Potential for Metal-Ligand Speciation in Aqueous Solution via the Liquid Sampling- Atmospheric Pressure Glow Discharge (LS-APGD) Ionization Source: Uranyl Acetate," *Anal. Chem.*, **2015**, 87, 7218-7225.

\*11. **B.T. Manard**, S. Harris, and R. K. Marcus, "Capillary-Channeled Polymer (C-CP) Fibers for the Rapid Extraction of Proteins from Urine Matrices Prior to Detection with MALDI-MS," **2014**, *Proteomics Clin. Appl.* in a special issue regarding Urine Proteomics, **2015**, 9, 522-530.

\*10. **B.T. Manard**, S. Konegger-Kappel, J.J. Gonzalez, J. Chirinos, M. Dong, X. Mao, R.E. Russo, and R. K. Marcus, "Liquid Sampling-Atmospheric Pressure Glow Discharge as a Secondary Excitation Source for Laser Ablation-Generated Aerosols: Parametric Dependences and Robustness to Particle Loading," *Appl. Spectrosc.*, **2015**, 69, 58-66.

9. S. Konegger-Kappel, **B.T. Manard**, L.X. Zhang, T. Konegger, R. K. Marcus, "Liquid Sampling-Atmospheric Pressure Glow Discharge Excitation of Atomic and Ionic Species," *J. Anal. At. Spectrom.* for inclusion in the special issue dedicated to Barry Sharp, **2014**, 30, 285-295.

8. L.X. Zhang, **B.T. Manard**, Stefanie Konegger Kappel, and R.K. Marcus, "Evaluation of the Operating Parameters of the Liquid Sampling-Atmospheric Pressure Glow Discharge (LS-APGD) Ionization Source for Elemental Mass Spectrometry," *Anal. Bioanal. Chem.*, special issue regarding emerging concepts and strategies with analytical glow discharges, **2014**, 406, 7497-7509.

\*7. **B.T. Manard**, J.J. Gonzalez, A. Sarkar, X. Mao, L. X. Zhang, S. Konegger-Kappel, R. K. Marcus, and R.E. Russo, "Investigation of Spectrochemical Matrix Effects in the Liquid Sampling-Atmospheric Pressure Glow Discharge (LS-APGD) Source," *Spectrochim. Acta B*, **2014**, 100, 44-51.

\*6. **B.T. Manard**, J.J. Gonzalez, X. Mao, A. Sarkar, M. Dong, J. Chirinos, R. E. Russo, and R. K. Marcus, "Liquid Sampling-Atmospheric Pressure Glow Discharge as a Secondary Excitation Source: Assessment of Plasma Characteristics" *Spectrochim. Acta B*, **2014**, 94-95, 39-47.

5. R. K. Marcus, C.Q. Burdette, **B.T. Manard**, Lynn X. Zhang, "Ambient Desorption/Ionization Mass Spectrometry using a Liquid Sampling-Atmospheric Glow Discharge (LS-APGD) Ionization Source," *Analyst*, **2013**, 405, 8171-8184.

\*4. **B.T. Manard**, R.K. Marcus, "Optimization of Capillary-Channeled Polymer (C-CP) Fiber Stationary Phase Extractions of Proteins from MALDI-MS Suppressing Media," *Anal. Methods*, **2013**, 5, 3194-3200.

\*3. **B.T. Manard** and R.K. Marcus, "Capillary-Channeled Polymer (C-CP) Fibers as a Stationary Phase for Sample Clean-Up of Protein Solutions for Matrix-Assisted Laser Desorption Ionization Mass Spectrometry," *J. Am. Soc. Mass Spectrom.*, **2012**, 23, 1419-1423.



2. C. D. Quarles Jr., **B.T. Manard**, C. E. Quarles, and R. K. Marcus, “**Role of Electrode Identity in Liquid Sampling-Atmospheric Pressure Glow Discharge-Optical Emission Spectroscopy**,” *Microchem.*, **2012**, 105, 48-55.

1. J.J. Pittman, **B.T. Manard**, P.J. Kowalski, and R. K. Marcus, “**Capillary-Channeled Polymer (C-CP) Films as Processing Platforms for Protein Analysis by Matrix-Assisted Laser/Desorption Ionization Mass Spectrometry (MALDI-MS)**,” *J. Am. Soc. Mass Spectrom.*, **2012**, 23, 102-107.

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## BOOK CHAPTERS

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1. J. Matonic, **B.T. Manard**, “Spectrochemical Measurements of Trace Elements in Actinide Materials by Direct Current Arc (DC-arc)” Published within the “The Plutonium Handbook”, D.L. Clark. **2018**.

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## PROCEEDINGS PUBLICATIONS

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7. R. Jubin, A. Dougan, P. Cable-Dunlap, B.W. Ticknor, J. Hewitt, **B.T. Manard**, W. Kuhne, K. McHugh, M. Nims, S. Stave, N. Stevens, “**Results of an In-Field Validation Exercise in Support of Wide-Area Environmental Sampling**” *Proceedings of the INMM 65<sup>th</sup> Annual Meeting*, July 22-25, 2024

6. V.C. Bradley, T.L. Spano, C.V. Thompson, B.W. Ticknor, P. Cable-Dunlap, D.R. Dunlap, S.C. Metzger, C.R. Hexel, and **B.T. Manard**, “**Direct Analysis of Cotton Swipes for Uranium and Plutonium Isotopic Determination by Microextraction-ICP-MS**” *Proceedings of the IRMM & ESARDA*, May 22-26, 2023.

5. **B.T. Manard**, B.W. Ticknor, V.C. Bradley, K.T. Rogers, S.C. Metzger, C.R. Hexel, “**Microextraction ICP-MS for Direct Analysis of Environmental Samples**”, Symposium on International Safeguards: Reflecting on the Past and Anticipating the Future, Vienna, Austria, October 31- November 4, 2022.

4. B. W. Ticknor, **B.T. Manard**, G. Chan, “**Review of Portable Mass Spectrometric and Alternative Techniques for Fieldable Enrichment Assay of UF<sub>6</sub> and Related Environmental Samples**” *Proceedings of the IRMM & ESARDA Joint Virtual Annual Meeting*, August 23-26 & August 30-September 1, 2021.

3. U. Martinez, S.K. Babu, E.F. Holby, X Yin, **B.T. Manard**, P. Zelany, “**Identification of Possible Degradation Mechanisms of PGM-Free Electrocatalysts during Fuel Cell Operation**” *The Electrochemical Society*, 1542, 2018.

2. G.E. McMath, **B.T. Manard**, E.M. Wylie, S.M. Aragon, “**Trace Element Analysis of Lead and Cadmium Dissolution in Water for Nuclear Applications**”, Advances in Nuclear Nonproliferation Technology and Policy Conference, Wilmington, NC, 2018.

1. C.J. Barinaga, G. H. Hager, G.L. Hart, D.W. Koppelaar, R.K. Marcus, S.M. Jones, **B.T. Manard**, **“Toward a Fieldable Atomic Mass Spectrometer for Safeguards Applications: Sample Preparation and Ionization,”** Symposium on International Safeguards: Linking Strategy, Implementation and People, Vienna, Austria, October 20-24, 2014.

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## REPORTS

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### Oak Ridge National Laboratory:

14. J.S. Denton, **B.T. Manard**, et al, **“International Interlaboratory Compilation of Trace Element Concentrations in the CUP-2 Uranium Ore Concentrate Standard”** LA-UR-21-25002. 2021.

13. D.A. Bostick, **B.T. Manard**, K.T. Rogers, C.R. Hexel, N.A. Zirakparvar, B.W. Ticknor, **“DOE Uranium Ore Concentrate Round-Robin Exercise 2020: ORNL Summary”** ORNL-TM-2021/2126. 2021.

12. B. W. Ticknor, **B.T. Manard**, G. Chan, **“Review of Portable Mass Spectrometric and Alternative Techniques for Fieldable Enrichment Assay of UF<sub>6</sub> and Related Environmental Samples-An Update”** ORNL-LTR-2021/1905. 2021.

11. K. T. Rogers, **B.T. Manard**, et al, **“Destructive Analysis of HEU Metal Report”** ORNL-SPR-2020/1511. 2020.

10. D. Bostick, B.W. Ticknor, C.R. Hexel, **B.T. Manard**, E. McBay, **“Uranium Sourcing Project 2018 – LLNL Solids SP-1 Round-Robin Exercise – ORNL Summary”** ORNL-LTR-2019/1074. 2019

### Los Alamos National Laboratory:

9. **B.T. Manard**, E.M Wylie, N. Xu, L. Tandon, **“Determination of Trace Elements in Uranium by HPLC-ID-ICP-MS: NTNFC Final Report”** LA-UR-17-29583. 2017

8. A.C. Olson, K. Bennett, A. L. Keksis, J. Berger, K.S. Boland, **B. T. Manard**, et. al, **“Activation Products in Technical Nuclear Forensics: Final Report”** LA-CP-17-20363. 2017

7. **B.T. Manard**, E. M. Wylie, N. Xu, et al, **“Trace Elements in Uranium Benchmarking Study”** LA-CP-17-20350. 2017

6. A.C. Olson, K. Bennett, J. Berger, S. Bowen, S. Kozimor, **B.T. Manard**, et. al, **“(U) Activation Products in Technical Nuclear Forensics”** LA-CP-17-00097. 2017

5. A.C. Olson, K. Bennett, J. Berger, S. Bowen, S. Kozimor, **B.T. Manard**, et. al, **“(U) Activation Products in Technical Nuclear Forensics”** LA-CP-16-00589. 2016

4. **B.T. Manard**, Benjamin Byerly, Ning Xu, and Lav Tandon, **“Determination of Trace Elements in Uranium and Plutonium by HPLC-ID-ICP-MS: NTNCF First Year Report”** LA-UR-16-22162. 2016

3. A.C. Olson, K. Bennett, J. Berger, S. Bowen, S. Kozimor, **B.T. Manard**, et. al, **“Activation Products in Technical Nuclear Forensics”** LA-UR-16-24190. 2015
2. Rebecca M. Chamberlin, **B.T. Manard**, et al., **“Process Development for Material at Risk (MAR) Reduction in Analytical Chemistry Operations: FY15 Year-End Report”** LA-CP-15-20515. 2015
1. Ning Xu, **B.T. Manard**, et al., **“FY 14 Material at Risk MAR Reduction Report on Trace Elemental Analysis”** LA-CP-14-20145. 2014

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## CONFERENCE / INVITED PRESENTATIONS

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28. **“Utilization of Laser-Based Sampling for High-Throughput Particle Analysis”** European Workshop on Laser Ablation, University of Ghent, Ghent, Belgium, July 6, 2024.
27. **“Inductively coupled plasma – mass spectrometry (ICP-MS) for single particle analysis”** *Invited presentation* to the Nuclear Security Course Lecture, University of Florida, Gainesville, FL, March 25, 2024.
26. **“Inductively coupled plasma – mass spectrometry (ICP-MS) for single particle analysis”** *Invited presentation* to the Department of Chemistry Seminar Series, University of Central Florida, Orlando, FL, March 11, 2024.
25. **“ORNL leading the new paradigm of analytical atomic spectroscopy”** *Invited presentation* to Chemical Sciences Division, Oak Ridge National Laboratory, February 7, 2024.
24. **“Analysis of Single Uranium Particles by ICP-MS”** *Invited presentation* at the Winter Conference on Plasma Spectrochemistry, Tucson, AZ, January 20, 2024.
23. **“LIBS (and LA) as an Alternative Approach to Traditional Analytical Workflows”** *Invited presentation* at the Winter Conference on Plasma Spectrochemistry, Tucson, AZ, January 18, 2024.
22. **“Utilization of Atomic Spectroscopy at National Labs – An Early Career’s Perspective”** B.T. Manard *Invited presentation* at the The Great Scientific Exchange (SciX), Sparks, NV, October 11, 2023.
21. **“Detection of uranium in complex matrices via laser-based sampling”** B.T. Manard, *Invited presentation* at the The Great Scientific Exchange (SciX), Sparks, NV, October 11, 2023.
20. **“Automated elemental and isotopic analysis of particles with single-particle inductively coupled plasma – time of flight – mass spectrometry”**, The Great Scientific Exchange (SciX), Sparks, NV, October 10, 2023.
19. **“Don’t wait, ABLATE! High speed laser ablation for elemental and isotopic mapping”** B.T. Manard, *Invited presentation* at the Glenn T. Seaborg Initiative (GTSI) External Workshop, Oak Ridge National Laboratory, May 11, 2023.

18. ***“From Sample to Isotopic Measurement – Unique Ways ORNL is Utilizing Innovative Sample Introduction”*** B.T. Manard, ***Invited presentation*** withing the Radioisotope Portfolio Seminar Series, Oak Ridge National Laboratory, October 13, 2022.
17. ***“Direct Analysis of Swipe Surface for Uranium by a Novel Microextraction-ICP-MS Approach”*** B.T. Manard, ***Invited presentation*** at The Great Scientific Exchange (SciX), Greater Cincinnati, OH, October 06, 2022.
16. ***“The Employment of ICP-MS for the Analysis of Nuclear Materials”*** B.T. Manard, ***Invited presentation*** at The Great Scientific Exchange (SciX), Atlanta, GA, October 13-18, 2018.
15. ***“Trace elements in uranium benchmarking study – emphasis on the HPLC-ID-ICP-MS methodology”*** B.T. Manard, E.M Wylie, N. Xu, D. Montoya, S. Aragon, M.S. Rearick, M.F. Schappert, L. Tandon. *Methods and Applications of Radioanalytical Chemistry*, Kailua-Kona, HI, April 8-13, 2018.
14. ***An Analytical Chemist’s Journal from Clemson to Los Alamos – with focus on the Actinide Analytical Chemistry Capabilities and Research at Los Alamos National Laboratory”*** ***Invited presentation*** at Clemson University Chemistry Department Seminar Series, Clemson, SC, November 9, 2017.
13. ***“Laser based chemical analysis technique for the characterization and mapping of uranium particles”*** B.T. Manard, C.D Quarles Jr, N. Xu, and E.M. Wylie, ***Invited presentation*** to the Young Scholars Symposium at the Rocky Mountain Regional Meeting, Loveland, CO, October 25-28, 2017.
12. ***“The Liquid Sampling – Atmospheric Pressure Glow Discharge: A Miniaturized Plasma for Giant Problems in Nuclear Forensics”*** B.T. Manard, N. Xu, A. Castro, and R.K. Marcus, ***Invited presentation at*** The Great Scientific Exchange (SciX), Providence, RI, September 27 – October 2, 2015.
11. ***“DC Arc Spectroscopy – Plasma Characterization for Direct Solid Analysis of Nuclear Materials”*** B.T. Manard, J. Matonic, R. Jump, D. Montoya, A. Castro, and N. Xu, The Great Scientific Exchange (SciX), Providence, RI, September 27 – October 2, 2015.
10. ***“Integrating Microfluidics for the Miniaturization of Nuclear Material Analysis Techniques”*** B.T. Manard, N. Xu, J. Gao, Q. MuCulloch, R. Chamberlin, D. Montoya, and A. Castro, *Methods and Applications of Radioanalytical Chemistry*, Kailua-Kona, HI, April 12-17, 2015.
9. ***“Assessment of the Liquid Sampling-Atmospheric Pressure Glow Discharge (LS-APGD) as an Ambient Desorption/Ionization Source for Mass Spectrometry”*** B.T. Manard, L.X. Zhang, and R.K. Marcus, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Chicago, IL, March 2-4, 2014.
8. ***“Assessment of Capillary-Channeled Polymer (C-CP) Films Employed for Protein Separations Prior to Analysis by MALDI-MS”*** B.T. Manard and R.K. Marcus, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Chicago, IL, March 2-4, 2014.

7. ***“Liquid Sampling-Atmospheric Pressure Glow Discharge (LS-APGD) as a Secondary Excitation Source: Assessment of Plasma Characteristics”*** B.T. Manard, J.J. Gonzalez, M. Dong, A. Sarkar, J. Chirinos, X. Mao, R.E. Russo, R.K. Marcus, presented at Winter Conference on Plasma Spectrochemistry, Amelia Island, FL, January 6-11, 2014.
6. ***“Assessment of the Liquid Sampling-Atmospheric Pressure Glow Discharge (LS-APGD) Rotational Temperature, Excitation Temperature, and Electron Number Density”*** B.T. Manard, J.J. Gonzalez, M. Dong, A. Sarkar, J. Chirinos, X. Mao, R.E. Russo, and R.K. Marcus, The Great Scientific Exchange (SCIX), Milwaukee, WI, September 29-October 4, 2013.
5. ***“Evaluation of an Ambient Desorption/Ionization Source Utilizing a Liquid Sampling-Atmospheric Pressure Glow Discharge (LS-APGD) for Mass Spectrometry,”*** B.T. Manard, C.Q. Burdette, and R.K. Marcus, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Philadelphia, PA, March 17-21, 2013.
4. ***“Optimization of Capillary-Channeled Polymer (C-CP) Fiber Packed Micro-SPE Tips for Extraction of Proteins Prior to MALDI-MS Analysis,”*** B.T. Manard and R.K. Marcus, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Philadelphia, PA, March 17-21, 2013.
3. ***“Separation of Proteins on Capillary-Channeled Polymer (C-CP) Films with Analysis by Matrix-Assisted Laser Desorption Ionization-Mass Spectrometry (MALDI-MS),”*** B.T. Manard, J.J. Pittman, and R.K. Marcus, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Orlando, FL, March 11-15, 2012.
2. ***“Investigation of the Effects of Electrode Material and Geometry in Liquid Sampling-Atmospheric Pressure Glow Discharge (LS-APGD) Microplasma Emission Spectroscopy and the Potential for Chromatography,”*** B.T. Manard, C.D. Quarles, Jr., C.Q. Burdette, and R.K. Marcus, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Orlando, FL, March 11-15, 2012.
1. ***“Separation of Proteins on Capillary-Channeled Polymer (C-CP) Films with Analysis by Matrix-Assisted Laser Desorption Ionization-Mass Spectrometry (MALDI-MS),”*** B.T. Manard and R.K. Marcus, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Atlanta, GA, March 13-18, 2011.

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## NEWS ARTICLES

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1. <https://phys.org/news/2021-10-quick-uranium-isotopes-safeguard-nuclear.html>
2. <https://www.ans.org/news/article-3353/ornl-researchers-employ-extraction-probe-for-rapid-safeguards-analysis/>
3. <https://www.ornl.gov/news/quick-detection-uranium-isotopes-helps-safeguard-nuclear-materials>

4. <https://www.eurekalert.org/news-releases/931727>
5. <https://www.sciencedaily.com/releases/2015/05/150526124904.html>
6. <https://theanalyticalscientist.com/power-list/2022/benjamin-t-manard>
7. [https://blogs.rsc.org/ja/2023/11/22/jaas-emerging-investigator-lectureship-2023-recipient/?doing\\_wp\\_cron=1701780275.8654999732971191406250](https://blogs.rsc.org/ja/2023/11/22/jaas-emerging-investigator-lectureship-2023-recipient/?doing_wp_cron=1701780275.8654999732971191406250)
8. <https://www.eurekalert.org/news-releases/1009420>

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### Funding (PI/Co-PI)

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NNSA – Office of Defense Nuclear Nonproliferation R&D **\$1454K FY24-25**  
*Single Particle – Microextraction – Mass Spectrometry*

VA **\$1189K FY24-26**  
*Mass Spectrometry-Based Measurement of Elemental Species in Lung Biopsies from Iraq and Afghanistan Veterans*

LDRD **\$1490K FY23-24**  
*Next Generation Particle Mapping for Isotopic, Chemical, and Elemental (MICE) Analysis*

LDRD **\$83K FY23**  
*Mass Spectrometry Analysis for Platinum Enzyme Engineering*

NNSA – Office of International Nuclear Safeguards – Technology Development **\$814K FY23-25**  
*Electrothermal Vaporization (ETV) of Pre-Inspection Check (PIC) Samples*

NNSA – Office of Defense Nuclear Nonproliferation R&D **\$1405K FY21-23**  
*Microextraction Sample Preparation Technique for Elemental and Isotopic Analysis*

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### HONORS AND AWARDS

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**Society for Applied Spectroscopy – Lester Strock Award** **2024**  
 “Substantive research in/or application of analytical atomic spectrochemistry”

*Journal of Analytical Atomic Spectroscopy* Emerging Investigator Lectureship **2023**

Office of the Laboratory Director’s 2023 LDRD Poster Fair – “Best Project” **2023**

<b>North American Workshop on Laser Ablation –</b> “3 <sup>rd</sup> place in Laser Ablation Image Contest.”	<b>2023</b>
<b><i>The Analytical Scientist</i> Power List: Top 40 Under 40</b> “Analytical science’s rising stars”	<b>2022</b>
<b>Department of Energy Secretary’s Honor Award</b> “DOE’s highest form of employee recognition for excellence and achievements”	<b>2022</b>
<b><i>Journal of Analytical Atomic Spectroscopy</i> Featured Young Analytical Scientist</b>	<b>2017</b>
<b>Glenn T. Seaborg Postdoctoral Fellow</b>	<b>2015</b>

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#### PROFESSIONAL SOCIETIES AND ACTIVITIES

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##### ***Applied Spectroscopy Practica***

Associate Editor	<b>2023-Present</b>
Editorial Advisory Board	<b>2023-Present</b>

##### **Society for Applied Spectroscopy:**

Member	<b>2011-Present</b>
Governing Board Member	<b>2023-Present</b>
Atomic Spectroscopy Student Award Co-Chair	<b>2019-Present</b>
Executive Committee, Parliamentarian	<b>2015-2020</b>
Lester Strock Award Committee	<b>2017, 2018</b>
Nomination Committee	<b>2018-2020</b>
Constitution and Bylaws Committee	<b>2019-2021</b>

##### **Federation of Analytical Chemistry and Spectroscopy Studies (FACSS):**

Atomic Spectroscopy Co-Chair	<b>2019-Present</b>
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##### **Los Alamos National Laboratory:**

Glenn T. Seaborg Post-doctoral Fellow	<b>2015-2016</b>
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National Postdoctoral Association, <b>Past Member</b>	<b>2014-2016</b>
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##### **Los Alamos Postdoctoral Association:**

Past Member	<b>2014—2016</b>
Treasurer	<b>2015</b>
Vice President	<b>2016</b>

Clemson University Chemistry Graduate Student Organization, <b>Past member</b>	<b>2009—2014</b>
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**Mentoring**

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<b>Nathaniel Fletcher</b> (Current employee at Y-12 security complex)	<b>2018-2021</b>
<b>Sarah K Wysor</b> (Senior Scientist at AMGEN)	<b>2019</b>
<b>Veronica C. Bradley</b> (Current Hoffman Postdoctoral Fellow, LBNL)	<b>2019-2024</b>
<b>Jessica Linson</b> (Current University of Missouri Graduate Student)	<b>2022</b>
<b>Jacob Burleson</b> (Current UC-Boulder Undergraduate Student)	<b>2023</b>
<b>William Burns</b> (Current Savannah State University Graduate Student)	<b>2019-current</b>
<b>Jordan Stanberry</b> (Current ORNL Postdoctoral Fellow)	<b>2024-current</b>
<b>Sarah Szakas</b> (Current ORNL Postdoctoral Fellow)	<b>2024-current</b>