Richard E. Russo, PhD

Senior Scientist: Lawrence Berkeley National Laboratory (July 1982 – current)
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Department Head: Lawrence Berkeley National Laboratory (October 2002 – October 2011)
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President and CEO: Applied Spectra, Inc (August 2004 – current)
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Experience

Dr. Russo is the founder and scientific director of the laser material interactions group at the Lawrence Berkeley National Laboratory. His group pioneered laser ablation for chemical analysis, with over 30 year's contribution to fundamental and applied research. Dr. Russo has an international scientific reputation in chemistry and physics related to nanosecond and femtosecond laser-material-interactions (laser ablation), is co-inventor of the nanowire laser, and developer of a real-time standoff laser ultrasonic sensor (R&D100 2006). He also is co-inventor of a patented process for nano-texturing (ITEX process) thin-films, lead-inventor of the patented ion-assisted pulsed laser deposition (IBAD process) which produced a world record critical current for HTSC materials, and a pioneer in elucidating fundamental laser heating and laser ablation processes for chemical analysis. His research group achieved world record 450nm spatial resolution and a detection limit of 220 attograms using a single femtosecond laser pulse for LIBS (laser induced breakdown spectroscopy) measurements. By pioneering near-field scanning optical microscopy (NSOM) with laser ablation, his group achieved 25nm diameter spatial resolution for sampling and analysis. Most recently, his Berkeley research group with the assistance of Applied Spectra staff demonstrated and patented the use of laser plasmas for real-time measurement of isotopes. The new technology has been named LAMIS (Laser Ablation Molecular Isotopic Spectroscopy), which won a 2012 R&D100 Award. Russo has over 250 Scientific Publications; 45 Refereed Proceedings; 320 (226 Invited) Presentations- Lectures, 10 Book Chapters and 15 Patents. Fourteen students have received their PhD degree under his direction at the University of California, Berkeley. Over 25 international students have performed part of their PhD research in Dr. Russo's Berkeley Laboratory. Many scientific visitors and faculty sabbatical members contribute to the core research group (15-20 staff) every year. Dr. Russo has received > $60M in R&D funding at LBNL for development and demonstration of laser ablation direct solid sampling related to nuclear non-proliferation, nuclear forensics, environmental monitoring and energy applications. The technology has been adapted throughout university, national laboratory and industrial applications.

Dr. Russo also is founder and president of Applied Spectra, Inc. (ASI). Russo founded ASI with the assistance of several of his PhD students from Berkeley. Together, they are the world experts in laser ablation chemical analysis using LIBS and Laser Ablation with ICP-OES and ICP-MS. Company core expertise is research, development and manufacture of laser ablation chemical analysis instrumentation, and analytical measurement services. Applied Spectra has transitioned Berkeley research into state-of-the-art analytical instruments. ASI LIBS and Laser Ablation instruments are utilized in national and international markets, including academia, national laboratories, industry, energy, environmental and security applications. These LIBS and LA-ICP-MS systems provide significant cost benefits to traditional chemical analysis, delivering real time elemental and isotopic analysis with excellent spatial and depth resolution, and without sample digestion. The company continues to advance laser ablation chemical analysis based on an expert in-house research team that provides superior analytical instrumentation and applications (methods) development.

Education

BS – Chemistry: University of Florida, Gainesville (1976-1978)
PhD – Chemistry, Laser Spectroscopy: Indiana University, Bloomington (1978 to 1981)

Professional:
Society of Applied Spectroscopy Strock Award 2013
Society of Applied Spectroscopy Strock Award 2005
Strock committee member (current)
R&D100 Award: 2006 (Laser Ultrasonic Sensor)
R&D100 Award: 2012 (LAMIS)
Short Courses on Laser Ablation, LIBS, LAMIS
Organizer for 21st Century LIBS Symposium (Pittcon)
Organizer of the 4th International Conference on Laser Ablation
FACSS/SciX, Pittcon Organizer: Laser Ablation Symposiums
FACSS/SciX, Pittcon: Workshop Organizer and Presenter
Winter Plasma Conference – planetary, invited and short courses
International Committee Member for Conference on Laser Ablation
Associate Editor: Applied Spectroscopy, Spectrochimica Acta B
Reviewer: NSF, DOE, DOD, NIH
Advisor on nuclear non-proliferation
Advisor on stand-off explosives detection
Consultant: New Wave Research (9 years), Tyco (2 years), LaserScope (1 year),
Expert witness patent infringement

Recent Publications:

1. Arnab Sarkar, Xianglei Mao, George C.-Y. Chan, Richard E. Russo, **Laser Ablation Molecular Isotopic Spectrometry of Water for $_1D^2/_1H^1$ ratio analysis,** Spectrochimica Acta 88, 46-53 (2013).
2. R.E. Russo, J.J . Gonzlaez, X.L. Mao, V. Zorba and J. Yoo, **Laser Ablation in Analytical Chemistry, Feature Article,** Analytical Chemistry, 85, 6162 (2013).
3. R.E. Russo, X.L. Mao, J.J. Gonzalez and J. Yoo, **Femtosecond versus Nanosecond Laser Pulse Duration for Laser Ablation Chemical Analysis**, Spectroscopy 28(1) 1 (2013).
4. I. Choi, G. C.-Y. Chan, X. Mao, D. L. Perry and R. E. Russo, **Spectral Properties and Sensitivity for Laser Induced Breakdown Spectroscopy (LIBS) of Uranium**, *to be published in Applied Spectroscopy November 2013*.
5. M. Dong, X.Mao, J.J. Gonzlaez, J.Lu and R.E. Russo, **Carbon isotope separation and molecular formation in laser-induced plasmas by laser ablation molecular isotopic spectrometry (LAMIS)**, Analytical Chemistry, 85, 2899-2906 (2013).
6. Y. Lu, V. Zorba, X. Mao, R. Zheng and R.E. Russo, **UV fs-ns Double-pulse Laser Induced Breakdown Spectroscopy for High Spatial Resolution Chemical Analysis,** Journal of Analytical Atomic Spectrometry 28, 743-748 (2013).
7. Russell. S. Harmon, Richard E. Russo, and Richard R. Hark, **GEOLIBS – A Review of the Application of Laser-Induced Breakdown Spectroscopy (LIBS) for Geochemical and Environmental Analysis**, 2012
8. A.A. Bol'shakov, J.H. Yoo, R.E. Russo, **Determining Key Isotopic Ratios in the Field**, NASA Technical Brief, November 2012.
9. Meirong Dong, Xianglei Mao, Jhanis Gonzalez, Jidong Lu, and Richard E Russo. 2012. **Time-Resolved LIBS of Atomic and Molecular Carbon From Coal in Air, Argon and Helium**. Journal of Analytical Atomic Spectrometry. 27, 2066 (2012)
10. Inhee Choi, Xianglei Mao, J Jhanis Gonzalez, and Richard E Russo. 2012. Plasma **Property Effects on Spectral Line Broadening in Double-Pulse Laser-Induced Breakdown Spectroscopy**. Applied Physics a Solids and Surfaces (August 30, 2012) doi:10.1007/s00339-012-7153-6.
11. Jhanis Gonzalez, Dayana D Oropeza, Henry Longerich, Xianglei Mao, and Richard E Russo. 2012. **Rapid Bulk Analysis Using Femtosecond Laser Ablation Inductively Coupled Plasma Time-of-Flight Mass Spectrometry.** Journal of Analytical Atomic Spectrometry. doi:10.1039/c2ja10368k.
12. A.A. Bol'shakov, J.H. Yoo, J.J. González, C. Liu, R.E. Russo, **Direct real-time determination of compositional profiles in structured materials using laser ablation instruments: LIBS and LA-ICP-MS**, Applied Industrial Optics Technical Digest
13. Sy-Bor Wen, Xianglei Mao, R.E. Russo, **Guiding and focusing of nanosecond infrared laser pulse with transient hollow plasma channels**, J. Phys. D: Appl. Phys. 45 (2012) 355203.

14. C. Quarles, J. Gonzalez, I. Choi, J. Ruiz, X. Mao, R. K. Marcus, and R. E. Russo, **Liquid Sampling-Atmospheric Pressure Glow Discharge Optical Emission Spectroscopy (LS-APGD-OES) Detection of Laser Ablation Produced Particles: A Feasibility Study,** Spectrochimica Acta B 76, 190 (2012)

15. V. Zorba, J. Syzdek, X.L. Mao, R.E. Russo and R. Kostecki, **Ultrafast LIBS for electrode/electrolyte interfaces**, Applied Physics Letters, 100, 234101 (2012); doi: 10.1063/1.4724203

16. B.G. Oztoprak, J.J. Gonzalez, J. Yoo, T. Gulecen, N. Mutlu, R.E. Russo, O. Gundogdu and A. Demir, **Analysis and Classification of Heterogeneous Kidney Stones Using LIBS**, *Applied Spectroscopy 66, 1353 (2012).*

17. Stolee, Jessica A., Walker, Bennett N., Zorba, Vassilia, Russo Richard E., and Vertes, Akos, **Laser–nanostructure interactions for ion production,** Physical Chemistry and Chemical Physics, 14, 8453 (2012).

18. Russo, R.E., Bol'shakov, A.A., Yoo, J.H., and Gonzalez, J.J., **Laser Ablation Plasmas for Diagnostics of Structured Electronic and Optical Materials During or After Laser Processing**, proceedings of LASE, SPIE SPIE, vol 8247, pp. 82430A–82430A (2012).

19. A.A. Bol'shakov, X. Mao, C.P. McKay, R.E. Russo, **Laser Ablation – Optical Cavity Isotopic Spectrometer for Mars rovers**, *Proc. SPIE*, v. 8385, paper 83850C (2012); DOI:10.1117/12.919905

20. Harmon, R. and Russo, R.E., **Laser-Induced Breakdown Spectroscopy,** "Spectroscopy VII" for *Treatise on Geochemistry 2nd Edition*, edited by Bill McDonough (2012).

21. González, J.J., Oropeza, D.D., Longerich, H., Mao, X.L., Russo, R.E., **Rapid bulk analysis using femtosecond laser ablation inductively coupled plasma Time-of-Flight mass spectrometry,** *Journal of Analytical Atomic Spectrometry 27, 1405 (2012).*

22. Mao, X.L., Bol'shakov, A.A., Perry, D.L., Sorkhabi, O., and Russo R.E., **Laser Ablation Molecular Isotopic Mass Spectrometry (LAMIS): Strontium and It's Isotopes,** *Spectrochimica Acta B66, 767-775 (2011).*

23. Carado, A.J., Quarles, C.D., Duffin, A.M., Barinaga, C.J., Russo, R.E., Marcus, R.K., Eiden,G., Koppenaal, D.W., **Femtosecond Laser Ablation Particle Introduction to a Liquid Sampling-Atmospheric Pressure Glow Discharge Ionization Source,** *J. Anal. At. Spectrom., 2012, 27 (3), 385 - 389*

24. Kasem, M.A., R.E. Russo, and M.A. Harith, **Influence of Biological Degradation and Environmental Effects on the Interpretation of Archeological Bone Samples with Laser Induced Breakdown Spectroscopy.** *Journal of Analytical Atomic Spectrometry. 2012*

25. Mao, X.L., Bol'shakov, A.A., Perry, D.L., Sorkhabi, O., and Russo, R.E., **Laser Ablation Molecular Isotope Mass Spectrometry (LAMIS): Parameter Influence on Boron Isotope Measurements,** *Spectrochimica Acta, Part B, 66, 604-609 (2011).*

26. Russo, R.E., A.A. Bol'shakov, X.L. Mao, C.P. McKay, D.L. Perry, and O. Sorkhabi, **Laser Ablation Molecular Isotope Mass Spectrometry (LAMIS),** *Spectrochimica Acta, Part B, Vol. 66, Issue 2, pp. 99-104, (2011).*