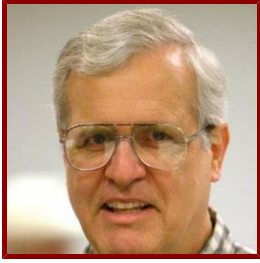


# Stanford

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## Piero Pianetta

Professor (Research) of Photon Science and of Electrical Engineering  
Photon Science Directorate

### Bio

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#### BIO

Pianetta's research is directed towards understanding how the atomic and electronic structure of semiconductor interfaces impacts device technology pertaining to advanced semiconductors and photocathodes. His research includes the development of new analytical tools for these studies based on the use of synchrotron radiation. These include the development of ultrasensitive methods to analyze trace impurities on the surface of silicon wafers at levels as low as  $1e-6$  monolayer ( $\sim 1e8$  atoms/cm<sup>2</sup>) and the use of various photoelectron spectroscopies (X-ray photoemission, NEXAFS, X-ray standing waves and photoelectron diffraction) to determine the bonding and atomic structure at the interface between silicon and different passivating layers. Recent projects include the development of high resolution ( $\sim 30$ nm) x-ray spectromicroscopy with applications to energy materials such as Li batteries.

#### ACADEMIC APPOINTMENTS

- Professor (Research), Photon Science Directorate
- Professor (Research), Electrical Engineering

#### ADMINISTRATIVE APPOINTMENTS

- Chair, Photon Science, SLAC, (2016- present)
- Deputy Director for SSRL, SLAC, (2014- present)
- Director (Interim) for SSRL, SLAC, (2012-2014)
- Deputy Director for SSRL, SLAC, (2010-2012)
- Director (Acting) for SSRL, SLAC, (2009-2010)
- Deputy Director for SSRL, SLAC, (2005-2009)
- Assistant Director for SSRL, SLAC, (1993-2005)
- Associate Director, Stanford Synchrotron Radiation Laboratory, (1985-1993)

#### HONORS AND AWARDS

- Fellow, American Physical Society (2006)

#### BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Chair, Experimental Systems Advisory Committee, Advanced Photon Source, Argonne National Laboratory (2015 - present)
- Associate Editor, Journal of Synchrotron Radiation (2009 - present)

#### PROFESSIONAL EDUCATION

- PhD, Stanford University , Applied Physics (1977)

- MS, Stanford University , Applied Physics (1973)
- BS, Santa Clara University , Physics (1971)

## PATENTS

- L. Hesselink, R.F.W. Pease, P. Pianetta, J.R. Maldonado, ^, Cheng, J. Ryan. "United States Patent 9,520,260 Photo emitter x-ray source array (PeXSA)", The Board of Trustees of the Leland Stanford Junior University, Palo Alto, CA (US), Dec 13, 2016
- J.R. Maldonado, Y-T Cheng, P. Pianetta, R.F.W. Pease, L. Hesselink. "United States Patent 9,406,488 Enhanced photoelectron sources using electron bombardment", The Board of Trustees of the Leland Stanford Junior University, Palo Alto, CA, Aug 2, 2016

## LINKS

- My SLAC faculty information: <https://faculty.slac.stanford.edu/photon-science-faculty-bios#Pianetta>
- My Google Scholar Page: [https://scholar.google.com/scholar?hl=en&as\\_sdt=0%2C5&q=piero+pianetta&btnG=](https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=piero+pianetta&btnG=)

## Teaching

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### COURSES

#### 2019-20

- The Electronic Structure of Surfaces and Interfaces: EE 329, PHOTON 329 (Aut)

#### 2017-18

- The Electronic Structure of Surfaces and Interfaces: EE 329, PHOTON 329 (Aut)

### STANFORD ADVISEES

#### Doctoral Dissertation Reader (AC)

Ponan Li, Mamdouh Nasr, Maha Yusuf

#### Orals Chair

Jiecheng Zhang

#### Postdoctoral Faculty Sponsor

Maged Abdelsamie, Nanda Gowtham Aduri, David Agyeman Budu, Florent Brondolo, Chuntian Cao, Hai Huang, Zhelong Jiang, Leah Kelly, Shaofeng Li, Julian Mars, Partha Paul, Suchismita Sarker, Archana Sinha, Eleanor Spielman-Sun, Gang Wan, Nicholas Weadock, Guibin Zan

#### Doctoral (Program)

Marc Jaikissoon, Ponan Li

## Publications

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### PUBLICATIONS

- **Machine-learning-revealed statistics of the particle-carbon/binder detachment in lithium-ion battery cathodes.** *Nature communications*  
Jiang, Z., Li, J., Yang, Y., Mu, L., Wei, C., Yu, X., Pianetta, P., Zhao, K., Cloetens, P., Lin, F., Liu, Y.  
2020; 11 (1): 2310
- **Quantifying redox heterogeneity in single-crystalline LiCoO<sub>2</sub> cathode particles.** *Journal of synchrotron radiation*  
Wei, C., Hong, Y., Tian, Y., Yu, X., Liu, Y., Pianetta, P.  
2020; 27 (Pt 3): 713–19
- **Operando Revealing Dynamic Reconstruction of NiCo Carbonate Hydroxide for High-Rate Energy Storage** *JOULE*  
Li, S., Zhang, Y., Liu, N., Yu, C., Lee, S., Zhou, S., Fu, R., Yang, J., Guo, W., Huang, H., Lee, J., Wang, C., Kim, et al  
2020; 4 (3): 673–87

- **Revealing the inhomogeneous surface chemistry on the spherical layered oxide polycrystalline cathode particles** *CHINESE PHYSICS B*  
Jiang, Z., Li, S., Xu, Z., Nordlund, D., Ohldag, H., Pianetta, P., Lee, J., Lin, F., Liu, Y.  
2020; 29 (2)
- **Surface Photovoltage-Induced Ultralow Work Function Material for Thermionic Energy Converters** *ACS ENERGY LETTERS*  
Schindler, P., Riley, D. C., Bargatin, I., Sahasrahudde, K., Schwede, J. W., Sun, S., Pianetta, P., Shen, Z., Howe, R. T., Melosh, N. A.  
2019; 4 (10): 2436–43
- **Simultaneous three-dimensional elemental mapping of Hollandite and Pyrochlore material phases in ceramic waste form materials** *JOURNAL OF THE AMERICAN CERAMIC SOCIETY*  
Damian, P. C., Cocco, A. P., Wrubel, J. A., Hong, T., Bordia, R. K., Liu, Y., Pianetta, P., Amoroso, J. W., Brinkman, K. S., Chiu, W. S.  
2019; 102 (9): 5620–31
- **Quantification of Heterogeneous Degradation in Li-Ion Batteries** *ADVANCED ENERGY MATERIALS*  
Yang, Y., Xu, R., Zhang, K., Lee, S., Mu, L., Liu, P., Waters, C. K., Spence, S., Xu, Z., Wei, C., Kautz, D. J., Yuan, Q., Dong, et al  
2019; 9 (25)
- **High-Voltage Charging-Induced Strain, Heterogeneity, and Micro-Cracks in Secondary Particles of a Nickel-Rich Layered Cathode Material** *ADVANCED FUNCTIONAL MATERIALS*  
Mao, Y., Wang, X., Xia, S., Zhang, K., Wei, C., Bak, S., Shadike, Z., Liu, X., Yang, Y., Xu, R., Pianetta, P., Ermon, S., Stavitski, et al  
2019; 29 (18)
- **Surface-to-Bulk Redox Coupling through Thermally Driven Li Redistribution in Li- and Mn-Rich Layered Cathode Materials.** *Journal of the American Chemical Society*  
Li, S., Lee, S. J., Wang, X., Yang, W., Huang, H., Swetz, D. S., Doriese, W. B., O'Neil, G. C., Ullom, J. N., Titus, C. J., Irwin, K. D., Lee, H. K., Nordlund, et al  
2019
- **Thermally driven mesoscale chemomechanical interplay in Li<sub>0.5</sub>Ni<sub>0.6</sub>Mn<sub>0.2</sub>Co<sub>0.2</sub>O<sub>2</sub> cathode materials** *JOURNAL OF MATERIALS CHEMISTRY A*  
Wei, C., Zhang, Y., Lee, S., Mu, L., Liu, J., Wang, C., Yang, Y., Doeff, M., Pianetta, P., Nordlund, D., Du, X., Tian, Y., Zhao, et al  
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- **Chemomechanical interplay of layered cathode materials undergoing fast charging in lithium batteries** *NANO ENERGY*  
Xia, S., Mu, L., Xu, Z., Wang, J., Wei, C., Liu, L., Pianetta, P., Zhao, K., Yu, X., Lin, F., Liu, Y.  
2018; 53: 753–62
- **Automatic projection image registration for nanoscale X-ray tomographic reconstruction.** *Journal of synchrotron radiation*  
Yu, H., Xia, S., Wei, C., Mao, Y., Larsson, D., Xiao, X., Pianetta, P., Yu, Y. S., Liu, Y.  
2018; 25 (Pt 6): 1819–26
- **Understanding the Effect of Local Short-Range Ordering on Lithium Diffusion in Li<sub>1.3</sub>Nb<sub>0.3</sub>Mn<sub>0.4</sub>O<sub>2</sub> Single-Crystal Cathode** *CHEM*  
Kan, W., Deng, B., Xu, Y., Shukla, A., Bo, T., Zhang, S., Liu, J., Pianetta, P., Wang, B., Liu, Y., Chen, G.  
2018; 4 (9): 2108–23
- **Propagation topography of redox phase transformations in heterogeneous layered oxide cathode materials** *NATURE COMMUNICATIONS*  
Mu, L., Yuan, Q., Tian, C., Wei, C., Zhang, K., Liu, J., Pianetta, P., Doeff, M. M., Liu, Y., Lin, F.  
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- **Mesoscale Battery Science: The Behavior of Electrode Particles Caught on a Multispectral X-ray Camera.** *Accounts of chemical research*  
Wei, C., Xia, S., Huang, H., Mao, Y., Pianetta, P., Liu, Y.  
2018
- **Scientific data mining in nanoscale visualization of catalysis at work**  
Liu, Y., Meirer, F., Weckhuysen, B., Pianetta, P.  
AMER CHEMICAL SOC.2018
- **Intensity modulation of the Shirley background of the Cr 3p spectra with photon energies around the Cr 2p edge** *SURFACE AND INTERFACE ANALYSIS*  
Herrera-Gomez, A., Cabrera-German, D., Dutoi, A. D., Vazquez-Lepe, M., Aguirre-Tostado, S., Pianetta, P., Nordlund, D., Cortazar-Martinez, O., Torres-Ochoa, A., Ceballos-Sanchez, O., Gomez-Munoz, L.  
2018; 50 (2): 246–52

- **Finding a Needle in the Haystack: Identification of Functionally Important Minority Phases in an Operating Battery** *NANO LETTERS*  
Zhang, K., Ren, F., Wang, X., Hu, E., Xu, Y., Yang, X., Li, H., Chen, L., Pianetta, P., Mehta, A., Yu, X., Liu, Y.  
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- **In situ Visualization of State-of-Charge Heterogeneity within a LiCoO<sub>2</sub> Particle that Evolves upon Cycling at Different Rates** *ACS ENERGY LETTERS*  
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- **Back-gated graphene anode for more efficient thermionic energy converters** *NANO ENERGY*  
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2017; 32: 67-72
- **Determination of copper nanoparticle size distributions with total reflection X-ray fluorescence spectroscopy** *JOURNAL OF SYNCHROTRON RADIATION*  
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- **Analysis of Cathodic Reaction Process of SiCl<sub>4</sub> during Si Electrodeposition in Ionic Liquids** *JOURNAL OF THE ELECTROCHEMICAL SOCIETY*  
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- **Interface Engineering for Atomic Layer Deposited Alumina Gate Dielectric on SiGe Substrates.** *ACS applied materials & interfaces*  
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- **Recent applications of hard x-ray photoelectron spectroscopy** *JOURNAL OF VACUUM SCIENCE & TECHNOLOGY A*  
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- **To get the most out of high resolution X-ray tomography: A review of the post-reconstruction analysis** *SPECTROCHIMICA ACTA PART B-ATOMIC SPECTROSCOPY*  
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- **Formation of Si<sup>1+</sup> in the early stages of the oxidation of the Si[001] 2x1 surface** *JOURNAL OF VACUUM SCIENCE & TECHNOLOGY A*  
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- **Characterization of electronic structure of periodically strained graphene** *APPLIED PHYSICS LETTERS*  
Aslani, M., Garner, C. M., Kumar, S., Nordlund, D., Pianetta, P., Nishi, Y.  
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- **Engineering Ultra-Low Work Function of Graphene** *NANO LETTERS*  
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- **High gradient rf gun studies of CsBr photocathodes** *PHYSICAL REVIEW SPECIAL TOPICS-ACCELERATORS AND BEAMS*  
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2015; 18 (4)
- **Registration of the rotation axis in X-ray tomography.** *Journal of synchrotron radiation*  
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2015; 22: 452-457
- **Evidence for an unorthodox firing sequence employed by the Berlin Painter: deciphering ancient ceramic firing conditions through high-resolution material characterization and replication** *JOURNAL OF ANALYTICAL ATOMIC SPECTROMETRY*  
Cianchetta, I., Trentelman, K., Maish, J., Saunders, D., Foran, B., Walton, M., Sciau, P., Wang, T., Pouyet, E., Cotte, M., Meirer, F., Liu, Y., Pianetta, et al

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- **Nanoscale Morphological and Chemical Changes of High Voltage Lithium Manganese Rich NMC Composite Cathodes with Cycling** *NANO LETTERS*  
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Maldonado, J. R., Cheng, Y. T., Pianetta, P., Pease, F. W., Hesselink, L.  
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2013; 46 (49)
- **The plastic nature of the human bone-periodontal ligament-tooth fibrous joint** *BONE*  
Ho, S. P., Kurylo, M. P., Grandfield, K., Hurng, J., Herber, R., Ryder, M. I., Alton, V., Aloni, S., Feng, J. Q., Webb, S., Marshall, G. W., Curtis, D., Andrews, et al  
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- **Microgravity Induces Pelvic Bone Loss through Osteoclastic Activity, Osteocytic Osteolysis, and Osteoblastic Cell Cycle Inhibition by CDKN1a/p21** *PLOS ONE*  
Blaber, E. A., Dvorochkin, N., Lee, C., Alwood, J. S., Yousuf, R., Pianetta, P., Globus, R. K., Burns, B. P., Almeida, E. A.  
2013; 8 (4)
- **Three-dimensional microstructural mapping of poisoning phases in the Neodymium Nickelate solid oxide fuel cell cathode** *SOLID STATE IONICS*  
Harris, W. M., Lombardo, J. J., DeGostin, M. B., Nelson, G. J., Luebke, H., Schuler, J. A., Van herle, J., Andrews, J. C., Liu, Y., Pianetta, P., Chen, Y. K., Wang, J., Chiu, et al  
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- **Nanoscale Examination of Microdamage in Sheep Cortical Bone Using Synchrotron Radiation Transmission X-Ray Microscopy** *PLOS ONE*  
Brock, G. R., Kim, G., Ingrassia, A. R., Andrews, J. C., Pianetta, P., van der Meulen, M. C.  
2013; 8 (3)
- **In Vacuo Photoemission Studies of Platinum Atomic Layer Deposition Using Synchrotron Radiation** *JOURNAL OF PHYSICAL CHEMISTRY LETTERS*  
Geyer, S. M., Methaapanon, R., Shong, B., Pianetta, P. A., Bent, S. F.  
2013; 4 (1): 176-179
- **Portable atomic layer deposition reactor for in situ synchrotron photoemission studies.** *Review of scientific instruments*  
Methaapanon, R., Geyer, S. M., Haggglund, C., Pianetta, P. A., Bent, S. F.  
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- **In Vacuo Photoemission Studies of Platinum Atomic Layer Deposition Using Synchrotron Radiation.** *The journal of physical chemistry letters*  
Geyer, S. M., Methaapanon, R., Shong, B., Pianetta, P. A., Bent, S. F.  
2013; 4 (1): 176-79
- **Study on the synthesis-microstructure-performance relationship of layered Li-excess nickel-manganese oxide as a Li-ion battery cathode prepared by high-temperature calcination** *JOURNAL OF MATERIALS CHEMISTRY A*  
Chen, W., Song, Y., Wang, C., Liu, Y., Morris, D. T., Pianetta, P. A., Andrews, J. C., Wu, H., Wu, N.  
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- **Data-processing strategies for nano-tomography with elemental specification** *SPIE X-ray Nanoimaging Conference - Instruments and Methods*  
Liu, Y., Cats, K. H., Weker, J. N., Andrews, J. C., Weckhuysen, B. M., Pianetta, P.  
SPIE-INT SOC OPTICAL ENGINEERING.2013
- **Portable atomic layer deposition reactor for in situ synchrotron photoemission studies** *REVIEW OF SCIENTIFIC INSTRUMENTS*  
Methaapanon, R., Geyer, S. M., Haggglund, C., Pianetta, P. A., Bent, S. F.  
2013; 84 (1)
- **Photocathode device using diamondoid and cesium bromide films** *APPLIED PHYSICS LETTERS*  
Clay, W. A., Maldonado, J. R., Pianetta, P., Dahl, J. E., Carlson, R. M., Schreiner, P. R., Fokin, A. A., Tkachenko, B. A., Melosh, N. A., Shen, Z.  
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- **Experimental verification of the 3-step model of photoemission for energy spread and emittance measurements of copper and CsBr-coated copper photocathodes suitable for free electron laser applications** *APPLIED PHYSICS LETTERS*  
Maldonado, J. R., Pianetta, P., Dowell, D. H., Corbett, J., Park, S., Schmerge, J., Trautwein, A., Clay, W.  
2012; 101 (23)
- **Formation of arsenolite crystals at room temperature after very high dose arsenic implantation in silicon** *APPLIED PHYSICS LETTERS*  
Meirer, F., Giubertoni, D., Demenev, E., Vanzetti, L., Gennaro, S., Fedrizzi, M., Pepponi, G., Mehta, A., Pianetta, P., Steinhäuser, G., Vishwanath, V., Foad, M., Bersani, et al  
2012; 101 (23)
- **Extended depth of focus for transmission x-ray microscope** *OPTICS LETTERS*  
Liu, Y., Wang, J., Hong, Y., Wang, Z., Zhang, K., Williams, P. A., Zhu, P., Andrews, J. C., Pianetta, P., Wu, Z.  
2012; 37 (17): 3708-3710
- **3D elemental sensitive imaging using transmission X-ray microscopy** *ANALYTICAL AND BIOANALYTICAL CHEMISTRY*  
Liu, Y., Meirer, F., Wang, J., Requena, G., Williams, P., Nelson, J., Mehta, A., Andrews, J. C., Pianetta, P.  
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- **TXM-Wizard: a program for advanced data collection and evaluation in full-field transmission X-ray microscopy** *JOURNAL OF SYNCHROTRON RADIATION*  
Liu, Y., Meirer, F., Williams, P. A., Wang, J., Andrews, J. C., Pianetta, P.  
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- **Formation Of Arsenic Rich Silicon Oxide Under Plasma Immersion Ion Implantation And Laser Annealing** *19th International Conference on Ion Implantation Technology (IIT)*  
Meirer, F., Demenev, E., Giubertoni, D., Gennaro, S., VANZETTI, L., Pepponi, G., Bersani, M., Sahiner, M. A., Steinhäuser, G., Foad, M. A., Woicik, J. C., Mehta, A., Pianetta, et al  
AMER INST PHYSICS.2012: 183-188
- **FULL FIELD IMAGING OF NICKEL OXIDATION STATES IN SOLID OXIDE FUEL CELL ANODE MATERIALS BY XANES NANOTOMOGRAPHY** *9th International Conference on Fuel Cell Science, Engineering and Technology*  
Harris, W. M., Nelson, G. J., Izzo, J. R., Grew, K. N., Chiu, W. K., Chu, Y. S., Yi, J., Andrews, J., Liu, Y., Pianetta, P.  
AMER SOC MECHANICAL ENGINEERS.2012: 267-269
- **ANALYSIS OF SOLID OXIDE FUEL CELL LSM-YSZ COMPOSITE CATHODES WITH VARYING STARTING POWDER SIZES** *ASME International Mechanical Engineering Congress and Exposition (IMECE)*  
Harris, W. M., Nelson, G. J., Lombardo, J. J., Cocco, A. P., Izzo, J. R., Chiu, W. K., Tanasini, P., Van herle, J., Comninellis, C., Andrews, J. C., Liu, Y., Pianetta, P., Chu, et al  
AMER SOC MECHANICAL ENGINEERS.2012: 581-584
- **Hard X-ray Nanotomography of Catalytic Solids at Work** *ANGEWANDTE CHEMIE-INTERNATIONAL EDITION*  
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2012; 51 (48): 11986-11990
- **Ultrathin ALD-Al<sub>2</sub>O<sub>3</sub> layers for Ge(001) gate stacks: Local composition evolution and dielectric properties** *JOURNAL OF APPLIED PHYSICS*  
Swaminathan, S., Sun, Y., Pianetta, P., McIntyre, P. C.  
2011; 110 (9)
- **Electron bombardment of films used for reducing spurious charge in electrostatic electron optics** *JOURNAL OF VACUUM SCIENCE & TECHNOLOGY B*  
Maldonado, J. R., Pease, F., Hitzman, C. J., Brodie, A. D., Petric, P., Bevis, C., McCord, M., Tong, W. M., Kidwingira, F., Pianetta, P., Bibee, M., Mehta, A., Bhatia, et al  
2011; 29 (6)
- **Three-dimensional imaging of chemical phase transformations at the nanoscale with full-field transmission X-ray microscopy** *JOURNAL OF SYNCHROTRON RADIATION*  
Meirer, F., Cabana, J., Liu, Y., Mehta, A., Andrews, J. C., Pianetta, P.  
2011; 18: 773-781
- **Transmission X-Ray Microscopy for Full-Field Nano Imaging of Biomaterials** *MICROSCOPY RESEARCH AND TECHNIQUE*  
Andrews, J. C., Meirer, F., Liu, Y., Mester, Z., Pianetta, P.  
2011; 74 (7): 671-681

- **Device quality Sb-based compound semiconductor surface: A comparative study of chemical cleaning** *JOURNAL OF APPLIED PHYSICS*  
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2011; 109 (11)
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- **Schottky barrier height reduction for metal/n-GaSb contact by inserting TiO<sub>2</sub> interfacial layer with low tunneling resistance** *APPLIED PHYSICS LETTERS*  
Yuan, Z., Nainani, A., Sun, Y., Lin, J. J., Pianetta, P., Saraswat, K. C.  
2011; 98 (17)
- **Three-dimensional mapping of nickel oxidation states using full field x-ray absorption near edge structure nanotomography** *APPLIED PHYSICS LETTERS*  
Nelson, G. J., Harris, W. M., Izzo, J. R., Grew, K. N., Chiu, W. K., Chu, Y. S., Yi, J., Andrews, J. C., Liu, Y., Pianetta, P.  
2011; 98 (17)
- **3D nanoscale chemical imaging of Li-ion battery electrodes** *241st National Meeting and Exposition of the American-Chemical-Society (ACS)*  
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- **Phase retrieval using polychromatic illumination for transmission X-ray microscopy** *OPTICS EXPRESS*  
Liu, Y., Andrews, J. C., Wang, J., Meirer, F., Zhu, P., Wu, Z., Pianetta, P.  
2011; 19 (2): 540-545
- **Sub-15 nm Photo-electron Source Using a Nano-aperture Integrated with a Nano-antenna** *Conference on Lasers and Electro-Optics (CLEO)*  
Cheng, Y., Takashima, Y., Maldonado, J. R., Scipioni, L., Ferranti, D., Pianetta, P. A., Hesselink, L., Pease, R. F.  
IEEE.2011
- **3D Imaging of Nickel Oxidation States using Full Field X-ray Absorption Near Edge Structure Nanotomography** *12th International Symposium on Solid Oxide Fuel Cells (SOFC)*  
Nelson, G. J., Harris, W. M., Izzo, J. R., Grew, K. N., Chiu, W. K., Chu, Y. S., Yi, J., Andrews, J. C., Liu, Y., Pianetta, P.  
ELECTROCHEMICAL SOC INC.2011: 1315-21
- **Comparison of X-ray Nanotomography and FIB-SEM in Quantifying the Composite LSM/YSZ SOFC Cathode Microstructure** *12th International Symposium on Solid Oxide Fuel Cells (SOFC)*  
Nelson, G. J., Harris, W. M., Lombardo, J. J., Izzo, J. R., Chiu, W. K., Tanasini, P., Cantoni, M., Van herle, J., Comninellis, C., Andrews, J. C., Liu, Y., Pianetta, P., Chu, et al  
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