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Frank Osterloh received M.A. and Ph.D. degrees in chemistry in 1994 and 1997 from the Carl von Ossietzky University in Oldenburg, Germany, after working under the guidance of Prof. Siegfried Pohl on the synthesis of nickel complexes and iron sulfur clusters related to the active centers of enzymes. He then completed postdoctoral training at Harvard University with Prof. Richard H. Holm on the synthesis of iron-molybdenum clusters as models for nickel-iron nitrogenase. Upon joining the faculty at the Chemistry Department at the University of California, Davis, in 2000 he initiated a research program on the chemistry of inorganic nanoparticles. His current research interests are centered on the chemical and photophysical properties of inorganic materials and their use for solar energy to fuel conversion. This includes the development of photocatalysts for hydrogen fuel generation via overall water splitting (artificial photosynthesis) and the study of photochemical charge transfer reactions with surface photovoltage spectroscopy. As of August 2022, Frank has authored 127 scientific publications, including three book chapters and several review articles. His publications received over 10,000 citations, based on Web of Science and his H-index is 47.

PROFESSIONAL PREPARATION

1994	Diploma (M.S.) in Chemistry, Department of Chemistry, Carl von Ossietzky Universität, Oldenburg, Germany
1997	Ph.D. in Chemistry *(summa cum laude)*, Department of Chemistry, Carl von Ossietzky Universität, Oldenburg, Germany Thesis title: *Synthesis and Characterization of novel Fe- and Ni-Complexes as Model Compounds for the Active Sites of NiFe-Hydrogenase and Ni-CO-Dehydrogenase*
1997 – 2000	Postdoctoral Fellow in Chemistry, Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA

APPOINTMENTS

2011 –	Professor, Department of Chemistry, UC Davis, CA.
2006 – 2010	Associate Professor, Department of Chemistry, UC Davis, CA.

2000 – 2005	Assistant Professor, Department of Chemistry, UC Davis, CA.
1997 – 2000	Postdoctoral Research Assistant, Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA.
1994 – 1997	Teaching Assistant, Department of Chemistry, Carl von Ossietzky University, Oldenburg, Germany

AWARDS AND FELLOWSHIPS

2016	Fellow of the Royal Society of Chemistry (RSC)
2014	Richard A. Glenn Award of the ACS (Division of Fuel Chemistry)
2012 & 2013	Research Corporation Scialog Collaborative Innovation Award
2010	Inorganic Nanoscience Award of the ACS (Division of Inorganic Chemistry)
2010	DAAD Research Visit Fellowship
1997–1999	Deutsche Forschungsgemeinschaft (DFG) Postdoctoral Fellowship

SERVICE TO PROFESSIONAL SOCIETIES

2020 - 22	Associate Editor for Materials Advances (RSC)
2019 - 22	Member, Organizing Committee, Electrochemical Society Meetings - Spring: Renewable Fuels via Artificial Photosynthesis for Heterocatalysis Symposium & Fall: Photocatalysts, Photoelectrochemical Cells, and Solar Fuels Symposium
2016 -	Member, Royal Society of Chemistry (RSC)
2016 -	Member, American Association for the Advancement of Science (AAAS)
2015 - 22	Member, Editorial Advisory Board of ChemNanoMat (Wiley-VCH)
2014 - 22	Associate Editor for Journal of Materials Chemistry A (RSC)
2014 - 22	Member, Photoelectrochemistry Working Group, Department of Energy
2014	Chair and Organizer, Song Jin Award Symposium, San Francisco ACS meeting
2014	Chair, ACS Division of Inorganic Chemistry, Nanoscience Subdivision
2013	Chair Elect, ACS Division of Inorganic Chemistry, Nanoscience Subdivision
2013 -	Member, Electrochemical Society (ECS)
2011 - 15	Member, Editorial Advisory Board of Chemistry of Materials (ACS)
2009 - 16	Member, Solar Hydrogen Nanotechnology IV-X conference committee, International Society for Optics and Photonics, SPIE
2000 -	Member, American Chemical Society (ACS)
1997 -	Member, German Chemical Society (GDCh)
2000-22	Independent journal referee: over 530 research papers evaluated
2000-22	Independent grant proposal referee: over 160 grant proposals evaluated

TEACHING

Homogenous Catalysis (228D, Graduate Level): taught in W11, W12, W13, W16

Transition Metal Chemistry (CHE 226, Graduate Level): taught in F00, F01, F02, F03, F04, F05, F07, and F08
General Chemistry (CHE 2AH, Undergraduate Level): taught in S01, S02, F09, W20
General Chemistry Honors (CHE 2B/2BH, Undergraduate Level): taught in W06, W07, W10, W12, W13
Inorganic Chemistry Fundamentals (CHE 124A, Undergraduate Level): taught in F11, F17
Main Group Element Chemistry (CHE 124B, Undergraduate Level): taught in W03, W04, W08, W09, W16, W18, W19, W20, W21, W22
Transition Element Chemistry (CHE 124C, Undergraduate Level): taught S07, S14, S17
Inorganic Chemistry Lab (124L, Undergraduate Level): taught in S04, S05, S15
Chemistry of Nanoparticles (CHE122/222, Graduate /Undergraduate Level): taught in S08, S09, S11, S12, S13, S14, S15, S17, W19, W21, W22
Chemistry of Magic (Freshman Seminar, Undergraduate Level): taught in Summer 07
Chemistry in Virtual Reality (First Year Seminar, Undergraduate Level): F21

COMMUNICATING AND INTERPRETING SCIENCE TO THE PUBLIC

1. Aug. 8, 2003, Chemistry Magic Show, Early Academic Outreach Program, 60 high school students
2. Aug. 18, 2003, Chemistry Magic Show, Aeggie Kids Camp, 40 elementary school kids
3. Aug. 19, 2003, Chemistry Magic Show, Early Academic Outreach Program, 40 high school students
4. Oct. 15, 2003, Hands-on Chemistry Demos, Majors and Activities Faire, Quad, UC Davis
5. Oct. 18, 2003, Hands-on Chemistry Demos, Preview Day, Recreation Hall, UC Davis
6. Oct. 25, 2003, Chemistry Magic Show, Explorit Science Center, Davis
7. Oct 31, 2003, Freaky Friday Burning Pumpkin Halloween show, in front of 194 lecture hall, UC Davis, approx. 30 students.
8. Jan. 17, 2004, Chemistry Magic Show, Explorit Science Center, Davis. 121 visitors (see newspaper article, "Weird Science", The Davis Enterprise, Jan 19, 2004)
9. April 17, 2004, Chemistry Magic Show, UC Davis Picnic Day, 1600 local visitors (see newspaper article "Fun for all Ages", The Davis Enterprise, April 18, 2004)
10. July 29, 2005, Explorit Science Center, 50 visitors, mostly children 8-12
11. August 4, 2005, Birch Lane Child Development center, 179 Lecture Hall, , 100 kids 8-14 years of age
12. August 5, 2005, Explorit Science Center, Davis, 40 visitors, mostly children, aged 8-12
13. Preview Day, ARC Pavillon, UC Davis, Saturday, 30-50 visitors
14. October 23, 2005, Farmers Market, Davis, Saturday, October 29, 2005, 100 attendees, all ages
15. Black engineering student community, Saturday, April 15, 2006, 179 Lecture Hall, 50 students, aged 12-16 years
16. Take your Daughter to work day, Thursday, April 27, 2006, chemistry building courtyard, 40 children

17. Picnic Day Magic show, Saturday, April 22, 2006, 123 Science Lecture Hall, ~2000 attendees, all ages.
18. Oxnard High School (Southern California), Friday, May 19, 2006, 30 chemistry courtyard, 25 high school students
19. Davis Explorit Center 'Chemistry Magic Show', Saturday, June 3, 2006, 45 attendees, 3-60 years old.
20. Magic show on Thursday (Dead Day), June 8, 2006, in room 179 chemistry, for 70 attendees.
21. Magic Show on Thursday, June 15, 2006 at the Cooper School in Vacaville, 120 attendees.
22. Hands-on demos at the Explorit Center in Davis on Thursday, June 22, 2006 50 attendees.
23. Hands-on demos at the Explorit Center in Davis on Thursday, June 29, 2006 69 attendees.
24. July 14, 2006, chemistry show at the UC Davis Alumni camp at Shady creek, Nevada City, CA ~ 60 UC Davis Alumina and their kids
25. Oct 21, 2006: Preview Day in ARC Pavilion, UC Davis: Hands-on demos
26. Mar 15, 2007, Demo in chemistry courtyard, 20 high school kids from Junior Science and Humanities Symposium at UC Davis
27. April 14, 2007, Picnic Day chemistry Magic Show, UC Davis campus, ~1600 visitors
28. April 18, 2007, Patwin Elementary School, Davis, CA
29. April 26, 2007, 3pm, TODS day, chemistry courtyard, 40 kids and their parents
30. May 24, 2007, 10am -4 pm Woodland High School Career Fair, 21 N West Street, Woodland, 100 high school students
31. June 20, 2007, 8pm, Cub Scout Summer Camp, Woodland, Nelson's Grove: 200 Children
32. July 10, 2007, 2-3 pm, Chemistry Building Courtyard, 15 teens from COSMOS program
33. July 13, 2007, 1-2 pm; Chemistry for 60 children from Child Development Center, Chemistry Building Courtyard
34. July 27, 2007, 10:30 am, UC Davis summer camp, 350 kids, 1100 Social Science Bldg, UC Davis
35. October 18, 2007, 1-2pm, Phoebe Hearst Elementary School, Sacramento, 80 kids
36. Oct 20, 2007, 12:30-2:30 pm, Preview Day, ARC Pavilion, UC Davis
37. Oct 27, 2007, 8-12 noon, Davis Fall Festival, Farmers Market, Davis
38. Nov 3, 2007, 1-4 pm, Explorit Center, Davis, Chemistry Magic Show
39. February 14, 2008, Liquid Nitrogen Ice cream ChemClub Party, Chemistry Building
40. April 8, 2008, Cub Scout Show, Davis, ~30 kids
41. April 19, 2008, UC Davis Picnic Day, 194 Lecture hall on campus, ~1600 visitors
42. April 24, 2008, TODS Day, Chemistry Building Courtyard, ~60 visitors
43. May 7, 2008, Show for Brownie Troop 2196, Davis, ~25 kids
44. July 9, Show for 180 High School Students from COSMOS program, Haring Hall 2205
45. July 18, 2008, Magic Show, Chemistry Building Courtyard, ~20 visitors
46. October 10, 2008, Magic Show at Letters and Science Centennial Open House, University Club, campus, ~40 visitors
47. October 18, 2008, Hands-on demos at Preview Day, ARC Pavilion, Campus.
48. October 25, 2008, Magic Show at Fall Festival, Farmers Market, Davis
49. June 5, 2009, Chemistry courtyard, Kit Carson school visit: 80 students
50. July 8, 2009, Chemistry Demos at 1 pm, 123 Science Lecture Hall, COSMOS Program

51. Oct 21, 2009, UC Davis Preview Day Hands on Demos (no pics)
52. Oct 31, 2009, Farmers Market Fall Festival
53. Oct 16, 2010, Preview Day
54. Aug 12, 2010, Birch Lane Science Camp
55. Jul 14, 2010, Cosmos Show
56. April 17, 2010, Picnic Day Chemistry Magic Show
57. April 17/2011, Picnic Day, the famous four Chemistry Magic Shows on Picnic Day for about 1600 people throughout the day.
58. April 26/2011, MLK School, a bigger show at MLK school for 600 students in grades K-8.
59. April 28/2011, TODS Show, an event for the "Take Our Daughters and Sons to Work Day" (TODS) for about 50 kids and adults.
60. July 20/2011, Chemistry show for about 200 high school students that came to UC Davis for the COSMOS summer program.
61. August 08/2011, Chemistry Show for Birch Lane Elementary Science Camp.
62. October 15/2011, Preview Day, Hands-on demos, ARC building, UC Davis campus.
63. October29/2011, Davis Farmers Market's Fall Festival, hands on demos.
64. February 14/2012, Chemistry show, Merryhill school, Davis.
65. February 25/2012, Chemistry show with Aimee Bryan, UC Davis, Chemistry courtyard.
66. April 21/2012, Picnic Day, Four chemistry magic shows, 194 lecture hall, UC Davis campus, approx. 2000 attendees, all ages.
67. April 26/2012, Take your daughters and sons to work day (TODS): Chemistry courtyard, 60 attendees, K-12 plus parents.
68. May 09/2012, EAOP school visit, Chemistry show, UC Davis, chemistry courtyard.
69. May 17/2012, STEM outreach, Chemistry show, UC Davis, chemistry courtyard, 50 kids, 6th grade.
70. May 31/2012, STEM outreach, Chemistry show, UC Davis, chemistry courtyard, 50 kids, 6th grade.
71. July 27/2012, COSMOS, chemistry show, chemistry courtyard, 50 kids.
72. August 09/2012, Birch Lane CDC, chemistry show, chemistry courtyard.
73. October 10/2012, Preview Day, Hands-on demos, ARC building, UC Davis campus, 200 visitors.
74. March 22/2013, Martin Luther King Junior School, Sacramento, Chemistry MagicShow, 600 kids, K-8.
75. April 21/2013, Picnic Day, Four chemistry magic shows, 194 lecture hall, UC Davis campus, approx. 2,000 attendees, all ages.
76. April 25/2013, Take your daughters and sons to work day (TODS): Chemistry courtyard, 60 attendees, K-12 and parents.
77. August 18/2013, 'Final Blast' Fundraiser, Explorit Science Museum, Davis, Chemistry show, 60 attendees.
78. April 24/2014, Take your daughters and sons to work day (TODS): Chemistry courtyard, 60 attendees, K-12 and parents.
79. May 29/2014, Birch Lane Elementary school, Davis, chemistry show, 200 kids.

80. September 07/2014, 'Final Blast' Fundraiser, Explorit Science Museum, Davis, Chemistry show, 80 attendees.
81. May 18/2015, Birch Lane Elementary school, Davis, chemistry show, 300 kids.
82. April 2017, Chemistry show at UC Davis during 'Take your Daughters to Work Day' for 80 kids and adults.
83. November 2017, Chemistry show at Beamer Elementary School (Woodland) for 150 kids.
84. May 2018, Chemistry show at Cesar Chavez Intermediate School in Sacramento for 200 kids.
85. May 2018, Chemistry show at Pioneer High School (Woodland) in for 40 kids and adults.
86. December 2019, Chemistry Show, Cesar Chavez Elementary school, Sacramento, 250 kids.
87. January 2021, Virtual Chemistry Show, "Sunshine to Fuel : How science can help power the planet", Birchlane Elementary school, 150 kids.
88. December 10/2021, Chemistry Show, John Still Middle school, Sacramento, 200, 4-6th graders.
89. March 09/22, Chemistry Show, Lee Middle School from Woodland, 70 7th graders

BROADCAST, PRINT OR ELECTRONIC MEDIA

1. Fractals, nature's best-kept secret, could help solve energy crisis, Magazine Article, 01/31/2012, The California Aggie.
2. Scientists Discover That Tiny Fractal Trees Could Hold Key to More Efficient Solar Cells, Website, 03/06/2012, https://phys.org/news/2012-03-tiny-fractal-trees-solar-power.html
3. Tiny trees for solar power, Website, 03/05/2012, http://www.news.ucdavis.edu.
4. Nature inspired solar cells based on tiny fractals might lead to improved efficiency, Website, 03/06/2012, https://www.zmescience.com/research/tiny-tree-fractal-silver-solar-cells-043934/
5. Silver fractal trees may lead to new solar cell, Website, 03/06/2012, https://www.ebmag.com/silver-fractal-trees-may-lead-to-new-solar-cell-12094/
6. Wikipedia: Quantum Dots, Section on Photocatalysts, Website, 2015, https://en.wikipedia.org/wiki/Quantum_dot
7. Wikipedia: Photokatalytische Wasserspaltung, Section on 'Photokatalyse mit suspendierten Partikeln', Website, 2015, https://de.wikipedia.org/wiki/Photokatalytische_Wasserspaltung
8. Photocatalytic Water Splitting, Video, 2013, https://www.youtube.com/watch?v=eRjzZ7wAw70
9. Synthesis of Nanoscale Tungsten Oxide, Video, 2013, https://www.youtube.com/watch?v=gov4Ti4ssCs
10. Preparation of a Tungsten Oxide Thin Film, Video, 2013, https://www.youtube.com/watch?v=FkGaXPaAh6g
11. Irradiation of Iron Oxide - An Oxygen Evolving Photocatalyst, Video, 2013, https://www.youtube.com/watch?v=A1cJu0lcybE

12. Kubelka Munk UV-Visible Spectrophotometer, Video, 2013, https://www.youtube.com/watch?v=gzile1JRsbk
13. Photoelectrochemical Analysis of Tungsten Oxide, Video, 2013, https://www.youtube.com/watch?v=Xt1J8VXYPUk
14. Surface Photovoltage Spectroscopy of Photocatalytic Materials, Video, 2013, https:// www.youtube.com/watch?v=-X0xgtFtiQ0
15. Explosive Power of Solar Hydrogen from Water Splitting, Video, 2014, https:// www.youtube.com/watch?v=Mkg__20Mjcc
16. Hydrogen peroxide generator could provide millions with clean water, Website, April 2017, Chemistry World / Royal Society of Chemistry. https://www.chemistryworld.com/news/hydrogen-peroxide-generator-could-provide-millions-with-clean-water/3007077.article
17. Solar reactor splits carbon dioxide into fuel, Website, March 2017, Chemistry World / Royal Society of Chemistry. https://www.chemistryworld.com/news/solar-reactor-splits-carbon-dioxide-into-fuel/2500528.article
18. Synthesis of the Aluminum doped Strontium Titanate Overall Water Splitting Photocatalyst, Video, 09/2018, NSF. https://www.youtube.com/watch?v=D0h1ZjU72Y8
19. Photocatalytic water splitting using baggie reactor, Video, 05/2019, NSD. https://www.youtube.com/watch?v=du_gWqPWUhQ
20. Virtual Reality View of the Aluminum doped Strontium Titanate Overall Water Splitting Photocatalyst, Video, 05/2019. https://www.youtube.com/watch?v=72qymwn7KO4
21. Water Splitting Closeup, Video, 05/2019, NSF. https://www.youtube.com/watch?v=G3ZR52ijmA8
22. Remarkably durable water splitting photocatalyst lasts for half a year,, CD ROM, 02/2019, RSC/ Chemistry World. https://www.chemistryworld.com/news/remarkably-durable-water-splitting-photocatalyst-lasts-for-half-a-year/3010101.article
23. Unraveling the photovoltaic properties of gallium nitride nanorods for solar water splitting, CD ROM, 10/2020, AIP Scilight. https://doi.org/10.1063/10.0002188

STUDENT MENTORSHIP

Graduate Students: Total number advised: 40
Undergraduate Students: Total number advised: 46
Visiting Researchers and Postdocs: Total number advised: 23

Ph.D. Theses:

1. Ruirui Han, 2020, Surface Photovoltage Spectroscopy Studies on Charge Separation in Dye-Sensitized Photoelectrodes and Metal Oxide Photocatalysts for Solar Hydrogen Generation
2. Alexandra Tucker De Denko, 2019, A Surface Photovoltage Study of Charge Separation in Dye-Sensitized Solar Cells and Doped Bismuth Vanadate Photocatalysts for Solar Energy Conversion

3. Zeqiong Zhao, 2019, Surface Photovoltage Spectroscopy and Photoelectrochemical Studies on Strontium Titanate and Gallium Phosphide Photocatalysts for Overall Water Splitting
4. Zongkai Wu, 2018, Photochemical Charge Separation in Metal Oxide Photocatalysts for the Solar Water Splitting Reaction
5. Benjamin Nail, 2017, Surface Photovoltage spectroscopy on Nanostructured Photocatalysts and Photovoltaic Thin-films for Solar Energy Conversion
6. Timothy L. Shelton, 2016, Photochemistry of Inorganic Nanomaterials for Solar Energy Conversion
7. Jiarui Wang, 2015, Photochemical Charge Transfer in Nanostructured Photocatalysts for Solar Hydrogen Production
8. Jing Zhao, 2015, Inorganic Nanocrystal Photocatalysts for Solar Energy Conversion
9. Troy K. Townsend, 2014, Inorganic Metal Oxide Nanocrystal Photocatalysts for Solar Fuel Generation from Water
10. Michael A. Holmes, 2013, Solar Energy Solutions Through Photocatalytic Water Splitting with Inorganic Nanomaterials, and Organic Photovoltaic Studies Utilizing Surface Photovoltage Spectroscopy
11. Rachel Lee Chamousis, 2013, Preparation, Electrochemical and Photocatalytic Studies on Inorganic and Organic Nanomaterials for Solar Energy Conversion
12. Mollie Rose Waller, 2012, Metal Oxide Semiconducting Nanomaterials as Tools for Solar Energy Conversion
13. Fredrick Andrew Frame, 2011, Development of Inorganic Nanomaterials as Photocatalysts for the Water Splitting Reaction
14. Mark Ryan Allen, 2010, Synthesis and Characterization of $LiMo_3Se_3$ Nanowires for Chemical Sensing Applications and of Nanosheets Derived from $K_2Ti_4O_9$, $KCa_2Nb_3O_{10}$, and $K_4Nb_6O_{17}$ for Photocatalytic Water Splitting
15. Owen Calvert Compton, 2008, Studies on the Photocatalytic Water Splitting Activity of Calcium Niobate Nanosheets and the Colloidal Crystallization of Gold Nanoparticles
16. Xiubin Qi , 2007, Chemical Sensing with $LiMo_3Se_3$ Nanowire Films
17. Jin Young Kim, 2006, Design and Properties of Nanoparticle-based Inorganic Structures with Optical, Magnetic, and Catalytic Functions
18. Hiroki Hiramatsu, 2005, Systematic Investigations on the Assembly and Properties of Multicomponent Nanostructures Comprised of Gold, Silver, Cadmium Selenide, and Silica Nanoparticles

M.S. Theses:

1. Jorie Marie Fields, 2013, Evaluation of Micro- and Nanostructured Nickel Oxide as Photocatalysts for Hydrogen Evolution from Water
2. Sarah L. Gee, 2006, Synthesis and Characterization of Cu_2Se, Cu_2O and CuO and the Testing of Their Photocatalytic Ability in Various Media

3. Nidhal Nick Akl, 2006, Molybdenum Selenide Nanowires: XPS studies and Use as Precursor for Electrically Conducting Porous Materials.
4. Jason S. Martino, 2003, Reactivity and Conductivity Studies on Nanowires derived from the Chevrel Phase $LiMo_3Se_3$

Undergraduate Theses:

1. Nathan Soland, 2020, Investigating Unusually Large Surface Photovoltages in Rhodium-doped Strontium Titanate: Evidence of Ferroelectric Effects From Surface Photovoltage Spectroscopy
2. Brett Hodges, 2021, Investigating the Formation and Width of Space-Charge Regions in Bismuth Vanadate and Molybdenum-Doped Bismuth Vanadate Particle Films with Surface Photovoltage Spectroscopy
3. Nhu Dang, 2020, Study of Copper Gallium Selenide Using Surface Photovoltage Spectroscopy

PUBLICATIONS (JOURNALS AND BOOKS)

1. Osterloh, F., W. Saak, D. Haase, and S. Pohl, *Nickel (II) complexes bound to an [Fe_4S_4] cluster via bridging thiolates: synthesis and crystal structures of model compounds for the active site of nickel CO dehydrogenase.* Chemical Communications, 1996(6): p. 777-778. http://dx.doi.org/10.1039/CC9960000777
2. Osterloh, F., *Synthese und Charakterisierung neuer Nickel-und Eisenkomplexe als Modelle für die aktiven Zentren von NiFe-Hydrogenase und Ni-CO-Dehydrogenase/Acetyl-CoA-Synthase*, in *Chemistry*. 1997, Carl von Ossietzky University. p. 153. http://chemgroups.ucdavis.edu/%7Eosterloh/pubs/ref_0.pdf
3. Osterloh, F., W. Saak, D. Haase, and S. Pohl, *Synthesis, X-ray structure and electrochemical characterisation of a binuclear thiolate bridged Ni-Fe-nitrosyl complex, related to the active site of NiFe hydrogenase.* Chemical Communications, 1997(10): p. 979-980. http://dx.doi.org/10.1039/A700884H
4. Osterloh, F., W. Saak, and S. Pohl, *Unidentate and Bidentate Binding of Nickel(II) Complexes to an Fe4S4 Cluster via Bridging Thiolates: Synthesis, Crystal Structures, and Electrochemical Properties of Model Compounds for the Active Sites of Nickel Containing CO Dehydrogenase/Acetyl-CoA Synthase.* Journal of the American Chemical Society, 1997. **119**(24): p. 5648-5656. http://dx.doi.org/10.1021/ja970194r
5. Osterloh, F., W. Saak, S. Pohl, M. Kroeckel, C. Meier, and A.X. Trautwein, *Synthesis and Characterization of Neutral Hexanuclear Iron Sulfur Clusters Containing Stair-like [Fe-6(mu(3)-S)(4)(mu(2)-SR)(4)] and Nest-like [Fe-6(mu(3)-S)(2)(mu(2)-S)(2)(mu(4))(mu(2)-SR)(4)] Core Structures.* Inorganic Chemistry, 1998. **37**(14): p. 3581-3587. http://dx.doi.org/10.1021/ic980039t
6. Osterloh, F., W. Saak, D. Haase, and S. Pohl, *Crystal structure of the Ni(II)-complex of a redox switched crown ether.* Polyhedron, 1999. **18**(14): p. 1957-1960. http://dx.doi.org/10.1016/S0277-5387(99)00075-3

7. Osterloh, F., Y. Sanakis, R.J. Staples, E. Munck, and R.H. Holm, *A Molybdenum-Iron-Sulfur Cluster Containing Structural Elements Relevant to the P-Cluster of Nitrogenase.* Angewandte Chemie, International Edition, 1999. **38**(13-14): p. 2066-2070. http://dx.doi.org/10.1002/(SICI)1521-3773(19990712)38:13/14%3C2066::AID-ANIE2066%3E3.0.CO;2-K
8. Schneider, J., R. Hauptmann, F. Osterloh, and G. Henkel, *(3,7-Diethyl-3,7-diazanonane-1,9-dithiolato-S,N,N ',S ')nickel(II).* Acta Crystallographica Section C, 1999. **C55**: p. 328-330. http://dx.doi.org/10.1107/S0108270198012578
9. Osterloh, F., B.M. Segal, C. Achim, and R.H. Holm, *Reduced Mono-, Di-, and Tetracubane-Type Clusters Containing the [MoFe3S4]2+ Core Stabilized by Tertiary Phosphine Ligation.* Inorganic Chemistry, 2000. **39**(5): p. 980-989. http://dx.doi.org/10.1021/ic991016x
10. Osterloh, F., C. Achim, and R.H. Holm, *Molybdenum-Iron-Sulfur Clusters of Nuclearities Eight and Sixteen, Including a Topological Analogue of the P-Cluster of Nitrogenase.* Inorganic Chemistry, 2001. **40**(2): p. 224-232. http://dx.doi.org/10.1021/ic000617h
11. Osterloh, F., *Solution Self-Assembly of Magnetic Light Modulators from Exfoliated Perovskite and Magnetite Nanoparticles.* Journal of the American Chemical Society, 2002. **124**(22): p. 6248-6249. https://doi.org/10.1021/ja025858y
12. Sanakis, Y., S.J. Yoo, F. Osterloh, R.H. Holm, and E. Munck, *Determination of Antiferromagnetic Exchange Coupling in the Tetrahedral Thiolate-Bridged Diferrous Complex [Fe2(SEt)6]2-.* Inorganic Chemistry, 2002. **41**(26): p. 7081-7085. http://dx.doi.org/10.1021/ic0204629
13. Hiramatsu, H. and F.E. Osterloh, *pH-Controlled Assembly and Disassembly of Electrostatically Linked CdSe-SiO2 and Au-SiO2 Nanoparticle Clusters.* Langmuir, 2003. **19**(17): p. 7003-7011. https://doi.org/10.1021/la034217t
14. Liu, K., L. Zhao, P. Klavins, F.E. Osterloh, and H. Hiramatsu, *Extrinsic magnetoresistance in magnetite nanoparticles.* Journal of Applied Physics, 2003. **93**: p. 7951-7953. http://dx.doi.org/10.1063/1.1556133
15. Liu, K., L. Zhao, P. Klavins, F.E. Osterloh, J. Nogues, C. Leighton, H. Masuda, K. Nishio, I.V. Roshchin, and I.K. Schuller. *Synthesis and Thermal Stability of Nanomagnets*. in *ICCE-10 Tenth Annual International Conference on Composites/Nano Engineering*. 2003. University of New Orleans.
16. Osterloh, F.E. and D.P. Hewitt, *A low temperature cluster condensation approach to CdS nanocrystals: oxidative aggregation of [Cd10S4Br4(SR)(12)]4- with sulfur.* Chemical Communications, 2003(14): p. 1700-1701. http://dx.doi.org/10.1039/B302266H
17. Osterloh, F.E., J.S. Martino, H. Hiramatsu, and D.P. Hewitt, *Stringing up the Pearls: Self-Assembly, Optical and Electronic Properties of CdSe- and Au-LiMo3Se3 Nanoparticle-Nanowire Composites.* Nano Letters, 2003. **3**(2): p. 125-129. http://dx.doi.org/10.1021/nl025739g
18. Hiramatsu, H. and F.E. Osterloh, *A Simple Large-Scale Synthesis of Nearly Monodisperse Gold and Silver Nanoparticles with Adjustable Sizes and with Exchangeable Surfactants.* Chem. Mater., 2004. **16**(13): p. 2509-2511. https://doi.org/10.1021/cm049532v
19. Osterloh, F., *Silica-gold nanoparticle clusters as chemical sensors.* SPIE The International Society for Optical Engineering, Nanotechnology e-Bulletin 3, 2004(September 2004): p. http://www.spie.org/app/EbulletinArchive/nano/091004nano/nanoSep04.html .

20. Osterloh, F., H. Hiramatsu, R. Porter, and T. Guo, *Alkanethiol-Induced Structural Rearrangements in Silica-Gold Core-Shell-type Nanoparticle Clusters: An Opportunity for Chemical Sensor Engineering.* Langmuir, 2004. **20**(13): p. 5553-5558. https://doi.org/10.1021/la0348719
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106. Hong, S., R.M. Doughty, F.E. Osterloh, and J.V. Zaikina, *Deep eutectic solvent route synthesis of zinc and copper vanadate n-type semiconductors – mapping oxygen vacancies and their effect on photovoltage.* Journal of Materials Chemistry A, 2019. **7**(19): p. 12303-12316. https://doi.org/10.1039/C9TA00957D
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108. Osterloh, F.E., *Chapter 7 Artificial Photosynthesis with Inorganic Particles*, in *Integrated Solar Fuel Generators*, Ian D Sharp, Harry A Atwater, and H.-J. Lewerenz, Editors. 2019, The Royal Society of Chemistry. p. 214-280.
109. Wu, Z., Z. Zhao, G. Cheung, R.M. Doughty, A.R. Ballestas-Barrientos, B. Hirmez, R. Han, T. Maschmeyer, and F.E. Osterloh, *Role of Surface States in Photocatalytic Oxygen Evolution with CuWO4 Particles.* J. Electrochem. Soc. , 2019. **166**(5): p. H3014-H3019. https://doi.org/doi:10.1149/2.0021905jes
110. Zhao, Z., R.V. Goncalves, S.K. Barman, E.J. Willard, E. Byle, R. Perry, Z. Wu, M.N. Huda, A.J. Moulé, and F.E. Osterloh, *Electronic structure basis for enhanced overall water splitting photocatalysis with aluminum doped SrTiO3 in natural sunlight.* Energy & Environmental Science, 2019. **12**: p. 1385-1395. https://doi.org/10.1039/C9EE00310J
111. Zhao, Z., E.J. Willard, J.R. Dominguez, Z. Wu, and F.E. Osterloh, *Depletion layer controls photocatalytic hydrogen evolution with p-type gallium phosphide particles.* Journal of Materials Chemistry A, 2019. **7**(30): p. 18020-18029. https://doi.org/10.1039/C9TA05879F
112. Zoellner, B., S. O'Donnell, Z. Wu, D. Itanze, A. Carbone, F.E. Osterloh, S. Geyer, and P.A. Maggard, *Impact of Nb(V) Substitution on the Structure and Optical and Photoelectrochemical Properties of the Cu5(Ta1–xNbx)11O30 Solid Solution.* Inorganic Chemistry, 2019. **58**(10): p. 6845-6857. https://doi.org/10.1021/acs.inorgchem.9b00304
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115. Dalapati, G.K., L.H. Wong, and F.E. Osterloh, *Research presented at Symposium P of the 10th International Conference of Materials and Advanced Technology (ICMAT 2019).* Journal of Materials Chemistry A, 2020. **8**(3): p. 843-844. https://doi.org/10.1039/C9TA90275A
116. Doughty, R.M., F.A. Chowdhury, Z. Mi, and F.E. Osterloh, *Surface photovoltage spectroscopy observes junctions and carrier separation in gallium nitride nanowire arrays for overall water-splitting.* The Journal of Chemical Physics, 2020. **153**(14): p. 144707. https://doi.org/10.1063/5.0021273
117. Doughty, R.M., B. Hodges, J. Dominguez, R. Han, Z. Zhao, S. Assavachin, and F.E. Osterloh, *Fermi Level Pinning Controls Band Bending and Photochemical Charge Separation in Particles of n-SrTiO3, n-SrTiO3:Al, and n-GaAs:Te.* The Journal of Physical Chemistry C, 2020. **124**(34): p. 18426-18435. https://doi.org/10.1021/acs.jpcc.0c04989
118. Han, R., T.-Y. Kim, T.W. Hamann, and F.E. Osterloh, *Photochemical Charge Separation and Dye Self-Oxidation Control Performance of Fluorescein, Rose Bengal, and Triphenylamine Dye-Sensitized Solar Cells.* The Journal of Physical Chemistry C, 2020. **124**(48): p. 26174-26183. https://doi.org/10.1021/acs.jpcc.0c09052
119. Han, R., M.A. Melo Jr, Z. Zhao, Z. Wu, and F.E. Osterloh, *Light Intensity Dependence of Photochemical Charge Separation in the BiVO4/Ru-SrTiO3:Rh Direct Contact Tandem Photocatalyst for Overall Water Splitting.* The Journal of Physical Chemistry C, 2020. **124**: p. 9724-9733. https://doi.org/10.1021/acs.jpcc.0c00772
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121. Widenmeyer, M., T. Kohler, M. Samolis, A.T.D. Denko, X. Xiao, W. Xie, F.E. Osterloh, and A. Weidenkaff, *Band Gap Adjustment in Perovskite-type Eu1−xCaxTiO3 via Ammonolysis.* Zeitschrift für Physikalische Chemie, 2020. **234**(5): p. 887-909. http://dx.doi.org/10.1515/zpch-2019-1429
122. Hong, S., S.J. Burkhow, R.M. Doughty, Y. Cheng, B.J. Ryan, A. Mantravadi, L.T. Roling, M.G. Panthani, F.E. Osterloh, E.A. Smith, and J.V. Zaikina, *Local Structural Disorder in Metavanadates MV2O6 (M = Zn and Cu) Synthesized by the Deep Eutectic Solvent Route: Photoactive Oxides with Oxygen Vacancies.* Chemistry of Materials, 2021. **33**(5): p. 1667-1682. https://doi.org/10.1021/acs.chemmater.0c04155
123. Osterloh, F.E., *Kinetic and Thermodynamic Considerations for Photocatalyst Design (Chapter 1)*, in *Heterogeneous Photocatalysis. From Fundamentals to Applications in Energy Conversion and Depollution*, J. Strunk, Editor. 2021, Wiley VCH. https://doi.org/10.1002/9783527815296.ch1
124. Hong, S., Y. Cheng, S. Hariyani, J. Li, R.M. Doughty, A. Mantravadi, A.N. Adeyemi, E.A. Smith, J. Brgoch, F.E. Osterloh, and J.V. Zaikina, *The Deep Eutectic Solvent Precipitation Synthesis of Metastable Zn4V2O9*. Inorganic Chemistry, 2022. 61(1): p. 154-169. https://doi.org/10.1021/acs.inorgchem.1c02511
125. Adeyemi, A.N., A. Venkatesh, C. Xiao, Z. Zhao, Y. Li, T. Cox, D. Jing, A.J. Rossini, F.E. Osterloh, and J.V. Zaikina, Synthesis of $SrTiO_3$ and Al-doped $SrTiO_3$ via the deep eutectic solvent route. Materials Advances, 2022, **3(11)**, p. 4736-4747. https://doi.org/10.1039/D2MA00404F
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Gregoire, M.Z. Ertem, I.D. Sharp, K.-S. Choi, J.S. Lee, O. Ishitani, J.W. Ager, R.R. Prabhakar, A.T. Bell, S.W. Boettcher, K. Vincent, K. Takanabe, V. Artero, R. Napier, B.R. Cuenya, M.T.M. Koper, R. Van De Krol, and F. Houle, The 2022 solar fuels roadmap. Journal of Physics D: Applied Physics, 2022, **55(32)**, p. 323003. https://doi.org/10.1088/1361-6463/ac6f97

127. Wuille Bille, B.A., A.C. Kundmann, F.E. Osterloh, and J.M. Velázquez, Ln10S14O (Ln = La, Pr, Nd, Sm) Oxysulfides: A Series of Direct n-Type Semiconductors. Chemistry of Materials, 2022. **34(16)**, p. 7553-7562. https://doi.org/10.1021/acs.chemmater.2c01244

SCIENTIFIC PRESENTATIONS

1. Invited: 'Inorganic Nanostructures by Self Assembly', Department of Chemistry, California State University, Sacramento, CA, November **2001**.
2. **'**Solution Self-Assembly of Magnetic Light Switches from Exfoliated Perovskite and Magnetite Nanoparticles'**,** NSF Workshop in Inorganic Chemistry, Santa Fe, NM, October **2002**.
3. Invited: 'Nanoscale Devices by Chemical Synthesis', Department of Chemistry, Boise State University, Boise, IN, June **2002**.
4. Invited: 'Nanostructured Materials and Devices by Linkage of Inorganic Nanoparticles', Department of Chemistry, University of California, Santa Cruz, CA, November **2002**.
5. Invited: 'Inorganic Colloid Based Materials and Devices', Department of Chemistry, Carl von Ossietzky Universität, Oldenburg, Germany, June **2002**.
6. Invited: 'Inorganic Colloid Based Materials and Devices', Los Alamos National Laboratory, Chemistry Division, NM, August **2002**.
7. 'Regioselective chemistry and reaction dynamics of silica-gold core-shell type nanoparticle composites', 225th Meeting of the American Chemical Society, New Orleans, LA. March **2003**.
8. Invited: 'Clusters of Inorganic Nanoparticles: Bonding, Properties and Applications', Department of Chemistry, University of Washington, Seattle, WA, May **2003**.
9. Invited: 'Clusters of Inorganic Nanoparticles: Bonding, Properties and Applications', Department of Chemistry, University of California, Santa Barbara, CA, April **2003**.
10. Invited: 'Clusters of Inorganic Nanoparticles: Structure, Bonding, Applications', Gordon Research Conference Inorganic Chemistry, Newport, RI, July **2003**.
11. 'Bottom-up assembly and properties of one- and two-dimensional magnetic and photoluminescent nanostructures', 227th Meeting of the American Chemical Society, Anaheim, CA, May **2004**.

12. 'LiMo$_3$Se$_3$ Nanowires as Programmable Chemical Sensors', 228th Meeting of the American Chemical Society, Philadelphia, CA, August **2004**.
13. Invited: 'Bottom-up assembly and properties of one- and two-dimensional magnetic and photoluminescent nanostructures', Mardi Gras conference, Louisiana State University, Baton Rouge, LA, February **2004**.
14. Invited: 'LiMo$_3$Se$_3$ Nanowires as Programmable Chemical Sensors', NSF workshop, Inorganic Materials and Nanoscience, Broomfield, CO, October **2004**.
15. 'Synthesis and real-time magnetic manipulation of biaxial inorganic nanostructures', 229th ACS Meeting of the American Chemical Society, San Diego, CA, March **2005**.
16. 'Directional Light Emission from ZnO-CdSe Nanoparticle Clusters', Pacifichem 2005, Honolulu, HI, December **2005**.
17. 'Mechanism of Chemical Sensing with LiMo$_3$Se$_3$ Nanowire Films', Pacifichem 2005, Honolulu, HI, December **2005**.
18. Invited: 'How to Use Chemistry to Make the World's Smallest Compasses and Flashlights', University of Redlands, Department of Chemistry, January **2005**.
19. Invited: 'Inorganic Nanoparticles as Versatile Building Blocks for the Construction of Pseudo 0-,1-, and 2-Dimensional Nanostructures with Magnetic, Optical, and Sensoric Functions', Department of Chemistry and Biochemistry, University of California, Los Angeles, CA, January **2005**.
20. Invited: 'Inorganic Nanoparticles as Versatile Building Blocks for the Construction of Pseudo 0-,1-, and 2-Dimensional Nanostructures with Magnetic, Optical, and Sensoric Functions', Department of Chemistry, University of New Orleans, New Orleans, LA, January **2005**.
21. Invited: 'How to use chemistry to make the worlds smallest flashlights and compasses', Department of Chemistry, Western Washington University, WA, February **2005**.
22. Invited: 'Inorganic Nanoparticles as Versatile Building Blocks for the Construction of Pseudo 0-,1-, and 2-Dimensional Nanostructures with Magnetic, Optical, and Sensoric Functions', University of California, Riverside, Department of Chemistry, CA, February **2005**.
23. Invited: 'How to use chemistry to make the worlds smallest flashlights and compasses', Department of Chemistry, Loyola Marymount University, CA, February **2005**.
24. Invited: 'Inorganic Nanoparticles as versatile Precursors for the Assembly of Pseudo 0-,1-, and 2-Dimensional Nanostructures with Magnetic, Optical, and Sensoric Functions', Department of Chemistry, Texas A&M University, TX, March **2005**.
25. Invited: 'Chemical Approaches to Functional Nanostructures Based on Inorganic Nanoparticles', Department of Chemistry, University of California, Berkeley, CA, April **2005**.

26. Invited: 'Inorganic Nanoparticles as Versatile Building Blocks for 0, 1, and 2D Functional Nanostructures', Department of Chemistry, University of California, Irvine, CA, April **2005**.
'How to use chemistry to make the worlds smallest flashlights and compasses', Department of Chemistry, University of Denver, NV, November **2005**.
'How to use chemistry to make the worlds smallest flashlights and compasses', Department of Chemistry, California State University, Los Angeles, CA, November **2005**.
27. Invited: 'How to Use Chemistry to Make the World's Smallest Compasses and Flashlights', Department of Chemistry and Biochemistry, University of Denver, Denver, CO, November **2005**.
28. Invited: 'Facile Synthesis and Surfactant Exchange of Oleylamine Coated Gold and Silver Nanoparticles', Tohoku University, Sendaj, Japan, January **2006**.
29. Invited: 'How to Use Chemistry to Make the World's Smallest Compasses and Flashlights', Department of Chemistry, Idaho State University, Pocatello, ID, February, **2006**.
30. Invited: 'Analyte binding and mechanism of $LiMo_3Se_3$ nanowire chemical sensors', Xiubin Qi, Frank E. Osterloh, S. A. Barriga, J. A. Giacomo, and S. Chiang, 40th Western Regional Meeting of the American Chemical Society, Los Angeles, CA, January, **2006**.
31. Invited: 'Planar Gold Nanoparticle Clusters as Microscale Mirrors', Frank E. Osterloh, Jin Y. Kim, 61st Northwest Regional Meeting of the American Chemical Society, Reno, NV, June **2006**.
32. Invited: 'How to Use Chemistry to Make the World's Smallest Compasses and Mirrors, Department of Chemistry, Willamette University, Salem, OR, November **2006**.
33. Invited: 'How to Use Chemistry to Build a Nanoscale Machine for Solar Hydrogen Generation from Water', Department of Chemistry and Biochemistry, Pomona College, March **2007**.
34. Invited: 'Nanomaterials for Chemical Sensing and Photochemical Hydrogen Generation', Frank Osterloh, NEAT Brown bag seminar, Department of Chemistry, UC Davis, May **2007**.
35. Invited: 'Inorganic Nanostructures for Photochemical Hydrogen Generation and Chemical Sensing Applications' Department of Chemistry and Biochemistry, UC San Diego, June **2007**.
36. Invited: 'My Tenure at UC Davis', Professors for the Future meeting, UC Davis, January **2008**.
37. Invited: "Layered inorganic semiconductors as nanostructured photocatalysts for hydrogen generation from water", First Tokyo University of Science International Collaboration Workshop, Tokyo University of Science, Tokyo, Japan, March **2008**.

38. Invited: "Towards multicomponent nanoparticle-based catalysts for solar hydrogen generation from water", 35th FACSS meeting in Reno, NV, September, **2008**.
39. Invited: "Inorganic materials as catalysts for photochemical water splitting – a nano-building block approach", Department of Physics, California State University, Fresno, CA, September **2008**.
40. Invited: "Nanoparticle-Assembled Catalysts for Photoelectrolysis of Water", Department of Chemistry, University of Washington, Seattle, WA, October **2008**.
41. "CdSe Nanoribbons as Photocatalysts for Hydrogen Evolution from Water", Materials Research Society Spring Meeting, San Francisco, March **2008**.
42. "A modular approach to photochemical water splitting catalysts using KCa2Nb3O10 nanosheets, IrO2 and Pt nanoparticles", American Chemical Society National Meeting, New Orleans, April **2008.**
43. "Photochemical Hydrogen Evolution from Water using CdSe Nanoribbons as Catalysts", American Chemical Society National Meeting, New Orleans, April **2008**.
44. "Electrical Detection of Aqueous Metal Ions with Metallic LiMo3Se3 Nanowire Sensors", American Chemical Society National Meeting, New Orleans, April **2008**.
45. "Effect of morphology in KNb6O17 nanosheets and nanoscrolls on photocatalytic H2 evolution from water", American Chemical Society National Meeting, New Orleans, April **2008**.
46. 'Nanoparticle-Assembled Catalysts for Solar Hydrogen Generation from Water', SPIE Meeting, San Diego, August **2008**.
47. 'Quantum-Confined CdSe Nanoribbons as Catalyst for Photochemical Hydrogen Evolution from Water', SPIE Meeting, San Diego, August **2008**.
48. Invited: "Nanoparticle-Assembled Catalysts for Water Photoelectrolysis", Department of Chemistry, UC Berkeley, Berkeley, CA, January **2009**.
49. Invited: "Photocatalytic water splitting properties of nanosheets derived from $K_2Ti_4O_9$", SPIE conference, San Diego, CA, August **2009.**
50. Invited: 'Making Fuel from Sunshine: Inorganic Nanomaterials for Photocatalytic Hydrogen Production" , Department of Chemistry, Wayne State University, September **2009.**
51. Invited: 'Making Fuel from Sunshine: Inorganic Nanomaterials for Photocatalytic Hydrogen Production" , Department of Chemistry, Michigan State University, September **2009**.
52. Invited: "Enhanced solar energy to hydrogen fuel conversion with a CdSe -MoS_2 nanoribbon photocatalyst, FACSS conference, Louisville, KY, October **2009.**

53. Invited: 'Making Fuel from Sunshine: Inorganic Nanomaterials for Photocatalytic Hydrogen Production" , Department of Chemistry, University of Delaware, December **2009**.
54. Invited: 'Inorganic Nanomaterials for Solar to Fuel Production", ICAM meeting, University of California, Davis, January **2010**.
55. "Labeling the active sites on the HCa2Nb3O10 nanosheet water-splitting photocatalyst", Erwin M Sabio, Dr. Miaofang Chi, Dr. Nigel Browning, Frank Osterloh, American Chemical Society National Meeting, San Francisco, March **2010**.
56. "Effects of particle size and defects in exfoliated calcium niobate nanosheets on photocatalytic H2 generation from water", Mollie R Waller, Arthur J Thibert, Erwin M Sabio, Delmar S Larsen, Frank E Osterloh, American Chemical Society National Meeting, San Francisco, March **2010**.
57. "CdSe:MoS2 nanoribbon composites as quantum confined photocatalysts for hydrogen evolution from solutions of sacrificial electron donors under visible light", F. A Frame, Frank E Osterloh, American Chemical Society National Meeting, San Francisco, March **2010**.
58. "Effects of simultaneous platinum and iridium dioxide deposition in asymmetric H2K2Nb6O17 nanoscrolls on photocatalytic water splitting", Troy K Townsend, Erwin Sabio, Frank Osterloh, ACS National Meeting, San Francisco, March **2010**.
59. Invited: 'Photocatalytic Water Splitting as a Sustainable Pathway to Hydrogen Fuel', UC Davis Solar Energy Seminar, Chemistry Department, UC Davis, February, **2010**
60. Invited: 'Inorganic Nanomaterials for Solar to Fuel Production", ICAM meeting, University of California, Davis, January **2010**.
61. Invited: 'Photocatalytic Water Splitting as a Sustainable Pathway to Hydrogen Fuel', UC Davis Solar Energy Seminar, Chemistry Department, UC Davis, February **2010**
62. Invited: 'Making Fuel from Sunshine: Inorganic Nanomaterials for Photocatalytic Hydrogen Production", Helmholtz Center Berlin, Germany, May **2010**
63. Invited: 'Inorganic Nanomaterials as Catalysts for Solar Energy to Fuel Conversion", Peking University, Beijing, China, May **2010**
64. Invited: 'Making Fuel from Sunshine: Inorganic Nanomaterials for Photocatalytic Hydrogen Production', American Chemical Society meeting, Boston, MA, August **2010**
65. 'Making Fuel from Sunshine: Inorganic Nanomaterials for Photocatalytic Hydrogen Production', University of Hamburg, Hamburg, Germany, November **2010**
66. Invited: 'Making Fuel with Sunlight – Opportunities with Nanomaterials and Beyond', Technical University Berlin, Germany, December **2010**
67. Invited: 'Inorganic Nanomaterials for Photocatalytic Water Splitting - Problems and Opportunities', Gordon Research Conference, Ventura, CA, January **2011**

68. Invited: 'Making Fuel from Sunshine and Water - How Nanomaterials Can Help', University of San Diego, San Diego, CA, Feb **2011**.
69. Invited: 'Hydrogen fuel generation via photocatalytic water splitting with inorganic nanoparticles', UC Energy Institute, UC Davis, Mar **2011**
70. Invited: 'Making Fuel from Sunshine and Water: Inorganic Nanomaterials for Photocatalytic Hydrogen Production', University of Illinois, Chicago, IL, May **2011**.
71. Invited: 'Do Inorganic Nanocrystals Catalyze Water Photoelectrolysis?', California Institute of Technology, Pasadena, CA, June **2011.**
72. Invited: 'A light assisted biomass fuel cell for renewable electricity generation', SPIE conference, San Diego, CA, August **2011**.
73. Invited: ''Bottlenecks in Water Splitting with Self-Supported Nanocrystal Photocatalysts'', UC Berkeley, Berkeley, CA, Oct. **2011.**
74. Invited: 'Photocatalytic Water Oxidation with Suspended alpha-Fe_2O_3 Particles' – Effects of Nanoscaling', Troy K. Townsend, Frank Osterloh, MRS Fall Meeting, Boston, MA, Nov. **2011.**
75. 'VO_2 Nanoribbons for Light-Facilitated Biomass Conversion into Hydrogen and Electricity,Rachel Chamousis, Frank Osterloh, GRC, Ventura, CA, February **2011**
76. 'VO_2 Nanoribbons for Light-Facilitated Biomass Conversion into Hydrogen and Electricity', Rachel Chamousis, Frank Osterloh, ACS, Anaheim, CA, March **2011**.
77. 'Using Surface Photovoltage Spectroscopy and Photoelectrochemistry to study the electronic properties of semiconductor nanocrystals under light excitation for water splitting application', Jing Zhao, Michael A. Holmes, Frank E. Osterloh. 243rd meeting of the American Chemistry Society, San Diego, CA, March **2012**.
78. 'Electrochemical Electron and Hole Potentials in Illuminated Niobate and Titanate Nanocrystal Water Splitting Photocatalysts', Frank E. Osterloh, Electrochemical Society Meeting, Seattle, WA, May **2012**.
79. Invited: 'Solar Hydrogen by Photocatalytic Water Splitting with Inorganic Nanocrystals', Portland State University, Portland, OR, February **2012.**
80. Invited: 'Artificial Photosynthesis as the 'Holy Grail' in Chemistry - Can Inorganic Nanocrystals point the way? ', Technical University Dresden, Dresden, Germany, July **2012**.
81. Invited: 'Enhancing Solar Energy to Fuel Conversion with Nanostructures', CRISP meeting, University of Colorado, Boulder, CO, August **2012**.
82. Invited: 'Using Surface Photovoltage Spectroscopy to study the charge separation properties of CdSe quantum dots and Niobium Oxide nanocrystals for photocatalytic solar energy conversion and hydrogen generation', Jing Zhao, Frank Osterloh, SPIE conference, San Diego, CA, August **2012**.

83. Invited: 'Bottom-Up Assembly of Nanoscale Heterojunctions for Photochemical Energy Conversion', Scialog Conference, Biosphere 2, Tucson, AZ, October **2012**
84. Invited: 'Fractals as a Promising Geometry for Enhanced Solar Energy Conversion', Scialog Conference, Biosphere 2, Tucson, AZ, October **2012**
85. Invited: 'Inorganic Nanostructures for Enhanced Photocatalytic Water Splitting ?!', Arlington, TX, November, **2012**
86. Invited: 'Solar energy conversion with nanostructured photocatalysts: Importance of entropy', SERMACS, Raleigh, NC, November, **2012**.
87. 'Nanoscale Strontium Titanate Photocatalysts for Overall Water Splitting', ACS Meeting, New Orleans, LA, April **2013.**
88. 'Detailed kinetic analysis of quantum confinement controlled photocatalytic water splitting with suspended CdSe nanocrystals', ACS Meeting, New Orleans, LA, April **2013.**
89. 'Surface photovoltage in PCBM/P3HT bulk heterojunction photovoltaic cells', ACS Meeting, New Orleans, LA, April **2013.**
90. 'Fractal electrode enhanced organic photovoltaic cells', ACS Meeting, New Orleans, LA, April **2013.**
91. 'Effect of Excited State Entropy on the Energy Conversion Efficiency with Excitonic Semiconductors', ACS Meeting, New Orleans, LA, April **2013.**
92. 'Controlling the Energetics of a Nanoscale Water Splitting Photocatalyst with Potential-determining Ions', Rachel Chamousis, Frank E. Osterloh, MRS Meeting, San Francisco, CA, April **2013.**
93. 'Detailed Analysis of Quantum Confinement Effect on Photocatalytic Hydrogen Generation with CdSe Quantum Dots', Jing Zhao; Michael A. Holmes; Frank E. Osterloh, MRS Meeting, San Francisco, CA, April **2013.**
94. Invited: 'Making Fuel from Sunshine with Inorganic Nanoparticles – Solar Energy Research at UC Davis', Western Washington University, Chemistry Department, Bellingham, WA, **Nov 2013**.
95. 'Controlling the energetics and activity of nanocrystal metal oxide water splitting catalysts with potential determining ions', ECS meeting, San Francisco, **Oct. 2013**.
96. 'Photochemical Charge Transfer in Niobium Oxide Nanocrystal Films Studied with Surface Photovoltage Spectroscopy', ECS meeting, San Francisco, **Oct. 2013**.
97. 'Evaluation of micro- and nanostructured nickel oxide as photocatalyst for hydrogen evolution from water', ECS meeting, San Francisco, **Oct. 2013**.
98. 'Rh-doped SrTiO3 nanocrystals as photocatalysts for visible light-driven hydrogen evolution from water', Jiarui Wang, Frank E. Osterloh, ECS meeting, San Francisco, **Oct. 2013**.

99. 'Evaluation of micro- and nanostructured nickel oxide as photocatalyst for hydrogen evolution from water, ECS meeting, San Francisco, **Oct. 2013**.

100. 'Photocatalytic water oxidation with suspended Fe2O3 (hematite) nanocrystals', Bronwyn Harrod, Nicholas Brune, Christopher Wong, Frank E. Osterloh, ECS meeting, San Francisco, **Oct. 2013**.

101. Invited: 'Hydrogen Fuel from Sunlight - Inorganic Nanostructures for the Photocatalytic Water Splitting Reaction', UNICAMP, Campinas, Brazil, **Dec. 2013.**

102. Invited: 'Hydrogen Fuel from Sunlight - Inorganic Nanostructures for the Photocatalytic Water Splitting Reaction', Workshop on Renewable Energy Sources and Nanotechnology, WREN2013, Belem, Brazil, **Dec. 2013**.

103. Invited: 'Inorganic nanostructures for photoelectrochemical and photocatalytic water splitting', Center for Electrochemistry at the University of Texas at Austin, February **2014**

104. Invited: 'Suspended Inorganic Nanocrystals as Photocatalysts for the Water Splitting Reaction, ACS meeting Dallas, April **2014**

105. Invited: 'Charge Generation and Transport in Nanocrystal Water Splitting Photocatalysts – Insights from Surface Photovoltage Spectroscopy', Jing Zhao, Frank E. Osterloh, ACS meeting Dallas, April **2014**

106. 'Specifically Adsorbed Ions Control Energetics and Activity of Nanocrystal Water Splitting Photocatalysts', Rachel L. Chamousis, Frank E. Osterloh, ACS meeting, Dallas, April **2014**

107. Invited: 'Inorganic (Nano-)materials for Solar Energy Conversion', Photoelectrochemistry workshop of the PEC working group, Stanford, April **2014**.

108. 'Optimization of the Fe2O3 (hematite) nanocrystal - NaIO4 photocatalytic water oxidation system', Bronwyn L Harrod, Nicholas Brune, Christopher Wong, Frank E. Osterloh, ACS meeting, Dallas, April **2014**

109. Invited: **'**Photochemical Charge Separation on the Nanoscale – Insights from Surface Photovoltage Spectroscopy', Frank Osterloh, Jing Zhao, Michael Holmes, ANSER symposium, Northwestern University, **May 2014**

110. Invited: 'Inorganic nanostructures for photocatalytic water splitting, NanoGE Solar Fuels conference, Montreal', June **2014**.

111. ' Suspended Inorganic Nanocrystals as Photocatalysts for the Water Splitting Reaction', Jing Zhao, Thomas Dittrich, Frank E. Osterloh, IPS 20, **July 2014**, Berlin.

112. 'Charge Generation and Transport in Nanocrystal Water Splitting Photocatalysts – Insights from Surface Photovoltage Spectroscopy', Jing Zhao, Thomas Dittrich, Frank E. Osterloh, IPS 20**, July 2014**, Berlin.

113. 'Specifically Adsorbed Ions Control Energetics and Activity of Nanocrystal Water Splitting Photocatalysts', Rachel L. Chamousis, Frank E. Osterloh, IPS 20, **July 2014**, Berlin.

114. 'Effect of Excited State Entropy on the Energy Conversion Efficiency with Excitonic Semiconductors', IPS 20, **July 2014**, Berlin.
115. Invited: 'Nanoscale Junctions for Water Splitting Photocatalysis', ACS meeting, San Francisco, **August 2014**
116. Student Invited Seminar: 'Nanoscale Junctions for Water Splitting Photocatalysis', UC Berkeley, **September 2014**
117. Invited: 'Nanostructures for Solar Energy Conversion – The Good and the Bad', University of Southern California, September **2014**
118. Invited: 'Maximum Theoretical Efficiency Limit of Excitonic Semiconductor Devices – Effect of Band Structure on Excited State Entropy', Scialog meeting, Tucson AZ, **October 2014**.
119. Invited: 'Photochemical charge separation processes in organic photovoltaic devices and water splitting photocatalysts', University of Cambridge, UK, **November 2014**
120. Invited: 'Nanoscale Junctions for Water Splitting Photocatalysis', MRS meeting, San Francisco, CA, **April 2015**
121. Invited: 'Specifically Adsorbed Ions Control Energetics and Activity of Nanocrystal Water Splitting Photocatalysts', MRS meeting, San Francisco, CA, **April 2015**
122. 'Synthesis and limits of p-CuBi2O4 nanocrystals as visible light photocatalyst for hydrogen evolution from water', Geetu Sharma, Frank E. Osterloh, MRS meeting, San Francisco, CA, **April 2015**
123. Invited: 'Photocatalytic water splitting with suspended inorganic nanostructures', Rideal Conference, Berlin, Germany, **March 2015**
124. Invited: 'Photocatalytic water splitting with suspended inorganic nanostructures', University of Szeged, Szeged, Hungary, **March 2015**
125. Invited: 'Nanoscale Junctions for Water Splitting Photocatalysis', SPIE meeting, San Diego, **Aug. 2015**
126. Invited: 'Artificial photosynthesis with suspended inorganic nanostructures', Department of Chemistry & Biochemistry, San Francisco State University, **Aug. 2015**
127. Invited: 'Solar Hydrogen Research in the US / Opportunities with Particle Suspension Reactors', DFG meeting in Cologne, **Oct 2015**
128. Invited: 'Measuring junction potentials at illuminated particle photocatalysts', Pacifichem meeting, Honolulu, Hawaii, **Dec. 2015**
129. Invited: 'Suspended inorganic nanostructures for photocatalytic water splitting', Pacifichem meeting, Honolulu, Hawaii, **Dec. 2015**
130. Invited: 'Nanoscale Junctions for Artificial Photosynthesis and Water Splitting Photocatalysis', King Abdullah University of Science & Technology (KAUST), Saudi Arabia, **Feb. 2016**

131. Invited: 'Basic Principles of Electrode reactions', Kyoto University, Kyoto, Japan, **Feb. 2016**
132. Invited: 'Fundamentals of Semiconductor Physics', Kyoto University, Kyoto, Japan, **Feb. 2016**
133. Invited: 'Basic semiconductor photoelectrochemistry', Kyoto University, Kyoto, Japan, **Feb. 2016**
134. Invited: 'Photocatalytic Water Splitting - Advanced topics', Kyoto University, Kyoto, Japan, **Feb. 2016**
135. Invited: 'Nanoscale Junctions for Artificial Photosynthesis and Water Splitting Photocatalysis', Kyoto University, Kyoto, Japan, **Feb. 2016**
136. Invited: 'Bioinspired Materials: Artificial Photosynthesis with suspended inorganic nanostructures', Kyoto University, Kyoto, Japan, **Feb. 2016**
137. Invited: 'Measuring Built-in Potentials at Particle Tandem Junctions', MRS meeting, Phoenix, AZ, **Mar 2016**
138. Invited: 'Water Oxidation Photocatalysis with suspended Fe2O3 particles', MRS meeting, Phoenix, AZ, **Mar 2016**
139. Invited: 'Artificial Photosynthesis with Suspended Inorganic Materials', Foothill College, Los Altos Hills, California, **May 2016**
140. Invited: 'Inorganic nanomaterials for artificial photosynthesis', 10+10 workshop, Department of Chemistry, University of California, Davis, **May 2016**
141. Invited: 'Observing Nanoscale Photochemical Charge Separation with Surface Photovoltage Spectroscopy', 38th DOE Solar Photochemistry P.I. Meeting, Gaithersburg, MD, **June 2016**
142. Invited: 'Artificial Photosynthesis with Suspended Inorganic Materials', Department of Applied Physics, CINVESTAV-IPN, Merida, Mexico, **July 2016**
143. Invited: 'Artificial Photosynthesis with Suspended Inorganic Particles', Department of Chemistry, University of Giessen, Germany, **Sept. 2016**
144. Invited: 'Solar Water Splitting with Particle Photocatalysts', DFG Summer school, Berlin, Germany, **Oct. 2016**
145. Invited: 'Observing Photochemical Charge Transport at Particle Based Tandem Junctions for Overall Water Splitting', Prime 2016, Honolulu, HI, **Oct 2016**
146. Invited: 'What can surface photovoltage spectroscopy (SPS) teach us about photochemical charge separation on the nanoscale?', Lawrence Berkeley National Lab, Berkeley, California, **Oct. 2016**
147. Invited: 'Water Splitting Photocatalysis with Inorganic Particles', Workshop 'Solar hydrogen generation: perspectives and research opportunities', Helmut Schmidt University Hamburg & Helmholtz Center Geesthacht, Germany, **Jan. 2017**

148. Invited: 'Artificial Photosynthesis with Particles', University of Michigan, Ann Arbor, Michigan, **Feb. 2017.**

149. Invited: 'Inorganic Nanostructures for Artificial Photosynthesis and Water Splitting Photocatalysis', Department of Chemistry, University of Nevada, Reno, **March 2017.**

150. Invited: 'Water Splitting Photocatalysis with Inorganic Particles', University of California, Berkeley, Berkeley, CA, **March 2017.**

151. Invited: 'Surface photovoltage spectroscopy as a screening tool for solar energy conversion materials and photocatalysts', ACS Meeting in San Francisco, **April 2017**.

152. Invited: 'Is it Photocatalysis or is it Photosynthesis? Developing Design Criteria for Enhanced Solar Energy Conversion and Photocatalytic Devices', ACS Meeting in San Francisco, **April 2017**.

153. 'Effect of Ligands on Photochemical Charge Transfer in CdSe Quantum Dot Films – A Surface Photovoltage Spectroscopy Study', Benjamin A. Nail, Matt J. Greaney, Haipeng Lu, Jing Zhao, Stephen E. Bradforth, Richard L. Brutchey, Frank E. Osterloh, ACS Meeting in San Francisco, **April 2017**.

154. 'Copper tungstate microcrystals as photocatalyst for water oxidation under visible light', Zongkai Wu, Frank E. Osterloh, ACS Meeting in San Francisco, **April 2017**.

155. 'Aluminum doped $SrTiO_3$ nanocrystals as photocatalyst for overall water splitting under sunlight' Zeqiong Zhao, Frank Osterloh, ACS Meeting in San Francisco, **April 2017**.

156. 'Photochemistry of a direct contact core-shell tandem photocatalyst for overall water splitting', Mauricio A. Melo Jr and Frank E. Osterloh, ACS Meeting in San Francisco, **April 2017**.

157. 'Photovoltage, Effective Bandgap and Photochemical Charge Transfer in Nanoscale Transition Metal (Cu, Fe, Mn, Ni) Doped $SrTiO_3$ Photocatalysts', Xiaoqing Ma, Frank E. Osterloh, ACS Meeting in San Francisco, April **2017**.

158. Invited: 'Artificial Photosynthesis with Inorganic Photocatalysts', REU program, Department of Chemistry, UC Davis, July **2017.**

159. Invited: 'Photocatalysis versus Photosynthesis - Design Criteria for Devices for Solar Energy Conversion and Photocatalysis', 6th International Conference on Semiconductor Photochemistry, Oldenburg, Germany, September **2017.**

160. Invited: 'Solar Water Splitting - Artificial Photosynthesis with Inorganic Particles', Advanced Light Source User meeting, Lawrence Berkeley National Laboratory, Berkeley, California, October **2017.**

161. Invited: 'Photocatalysis versus Photosynthesis - Design Criteria for Devices for Solar Energy Conversion and Chemical Conversions', International Symposium on Solar Energy Conversion and Semiconductor Photochemistry, Fokuoka, Japan, January **2018**.

162. Invited: 'Photocatalysis versus Photosynthesis - Design Criteria for Devices for Solar Energy Conversion and Chemical Conversions', Materials Research Society meeting, Phoenix, AZ, April **2018**.
163. Invited: 'Water Splitting Photocatalysis with Inorganic Particles', Center for Bioenergy and Photosynthesis, Arizona State University, Phoenix, AZ, April **2018**.
164. Invited: 'Quantum confinement controls effective band gap, photocatalytic H2 evolution and photovoltage in CdSe nanocrystals', Electrochemical Society Meeting, Seattle, May **2018**.
165. Invited: 'Thermodynamic Aspects of Devices for Solar Energy and Chemical Conversions', Electrochemical Society Meeting, Seattle, May **2018**.
166. Invited: 'Observing Nanoscale Photochemical Charge Separation with Surface Photovoltage Spectroscopy', Department of Energy Photochemistry meeting, Gaithersburg, June **2018**.
167. Invited: 'Artificial Photosynthesis with Inorganic Particles', 7th Annual Young Electrochemists Symposium by ECSBC Student Chapter, Simon Fraser University, Vancouver, Canada, July **2018**.
168. Invited: 'Artificial Photosynthesis with Inorganic Particles', Department of Chemistry, University of Melbourne, Melbourne, Australia, September **2018**.
169. Invited: 'Artificial Photosynthesis with Inorganic Particles', Department of Chemistry, University of Sydney, Sydney, Australia, September **2018**.
170. Contributed: 'Electronic Structure Basis for Enhanced Overall Water Splitting Photocatalysis of Doped Strontium Titanate in Direct Sunlight', NanoGe conference in Malaga, Spain, October **2018**.
171. Invited: 'Water Splitting Photocatalysis with Inorganic Particles', Department of Chemistry, University of Texas in Austin, Texas, October **2018**.
172. Invited: 'Surface photovoltage spectroscopy as a screening tool for solar energy conversion materials and photocatalysts', University of Twente, December **2018**
173. Invited: 'Photovoltage generation in next generation tandem devices for overall water splitting', Bunsen Meeting, Taormina, Sicily, Italy, April **2019**
174. Invited: 'Observing Photochemical Charge Separation with Surface Photovoltage Spectroscopy', Sapienza University, Rome, April **2019**
175. 'Role of Surface States in Photocatalytic Oxygen Evolution with CuWO4 particles', 235th, ECS meeting, Seattle, USA, May **2019**
176. 'Using Surface Photovoltage Spectroscopy to observe photovoltage generation at the interfaces of Cu2O, BiVO4, and Rh:SrTiO3 particles', 235th, ECS meeting, Seattle, USA, May **2019**

177. Invited: 'Photochemical Charge Separation in Cu2O/BiVO4 Bilayers and in the Rh:SrTiO3/BiVO4 Tandem Photocatalyst for Overall Water Splitting', 10th International Conference on Materials for Advanced Technologies (ICMAT), Singapore, June **2019**
178. Invited: "Particle Based Photocatalysts for Overall Water Splitting, Microscale Motion and Light Conference", Dresden, Germany, July **2019**
179. Invited: "Fundamentals and Challenges in Overall Water Splitting Photocatalysis with Inorganic Materials", University of Bayreuth, Germany, July **2019**
180. Invited: "Water Splitting Photocatalysis with Inorganic Particles, 7th International Conference on Semiconductor Photochemistry (SP7)", University of Milan, Italy, September **2019**
181. Invited: "Water Splitting Photocatalysis with Inorganic Particles, Ben Gurion University, Be'er Sheva, Israel, September **2019**
182. Invited: 'Photochemical Charge Separation in Solar Fuel Photocatalysts and Devices, Rutgers University', Newark, USA, October **2019**
183. Invited: 'Depletion layer and surface states control photocatalytic hydrogen (oxygen) evolution with p-type gallium phosphide (n-type CuWO4) particles', 3rd International Solar Fuels Conference (ISF-3), Hiroshima, Japan, November **2019**
184. Invited: 'Inorganic Materials for Solar Energy Conversion', ChemEnergy REU: Faculty Snapshot Virtual Presentation, Frank Osterloh, August **2020**
185. 'Depletion layer control photocatalytic hydrogen evolution with p-type gallium phosphide particles, ACS virtual Fall meeting, August **2020**
186. 'Surface photovoltage spectroscopy on $BiVO_4$–GaP layered particle films for investigation of tandem excitation', Anna Kundmann, Frank Osterloh, ACS virtual Fall meeting, August **2020**
187. 'Photocatalytic hydrogen evolution from n-type gallium phosphide suspensions', Anna Kundmann, Frank Osterloh, ACS virtual Fall meeting, August **2020**
188. 'Light Intensity Dependence of Photochemical Charge Separation in the $BiVO_4$/Ru-$SrTiO_3$:Rh Direct Contact Tandem Photocatalyst for Overall Water Splitting', Ruirui Han, Frank Osterloh, ACS virtual Fall meeting, August **2020**
189. 'Construction and Operation of a Core-Shell BiVO4/Ru-SrTiO3:Ru tandem photocatalyst for Overall Water Splitting', Frank E. Osterloh, GDCH Virtual meeting, September **2020**
190. Invited: 'Fermi Level Pinning Controls Photochemical Charge Separation in Particles of n-SrTiO3, n-SrTiO3:Al, and p-GaAs:Te', Frank Osterloh, Prime Virtual meeting, October **2020**
191. Invited: 'Surface Photovoltage Spectroscopy Observes Junctions and Carrier Separation in Gallium Nitride Nanowire Arrays for Overall Water Splitting', Rachel M Doughty, Faqrul A. Chowdhury, Zetian Mi, and Frank E. Osterloh, ECS virtual meeting, May **2021**

192. Invited: 'Using Inverted Surface Photovoltage to Measure Space Charge Regions in Nanostructured Solar Fuel Photocatalysts', Frank E. Osterloh and Rachel M. Doughty, DOE program virtual meeting, June **2021**
193. Invited: 'Using Inverted Surface Photovoltage to Measure Space Charge Regions in Nanostructured Solar Fuel Photocatalysts', Frank E. Osterloh and Rachel M. Doughty, DOE program virtual meeting, June **2021**
194. Poster presentation: "An approach to obtain real photovoltage of semiconductor as the water splitting driving force", Sahar Daemi, Chengcan Xiao, Frank Osterloh, 6th US-Germany Workshop on Artificial Photosynthesis, November **2021**
195. Invited: 'Ferroelectric Photovoltage Enhancement in Chromium-doped SrTiO3 Nanocrystal Photocatalysts for Hydrogen Evolution', Frank Osterloh, Pacifichem Virtual Meeting, **Dec 2021**
196. Invited: Keynote Speaker, 'My Career in Chemistry', UC Davis Career Conference in Chemistry, April **2022**, UC Davis