

## Curriculum Vitae

**Richard F. Hammen, Ph.D.**

**Founder and CEO, Lithiome, LLC.**

INSTITUTION AND LOCATION	DEGREE	YEAR	FIELD OF STUDY
Stanford University, Stanford, CA Chemistry	B.S.		1966
University of Wisconsin, Madison, WI Chemistry (Prof. Barry M. Trost, now at Stanford)	Ph.D.		1973
UCLA, Los Angeles, CA Chemistry (Professor Chris Foote)	Postdoc		1973

### Positions, Employment, and Projects

2023-present. Founder and President, Critical Elements Corp.  
 2021-2023. Founder and CEO of Neodymia LLC  
 2018-2023, Founder and CEO of Lithiome LLC.  
 2016-2018. Recovery of Germanium from an hydrochloric acid waste stream  
 2016-2018. Recovery of Nickel and Chromium from a metal plating wastestream  
 2014-2018. Production of gold from a refractory gold ore deposit  
 2014. Founder and Chairman, Metals US Inc.  
 2012-2015. Advisory Board, Ucore Rare Metals, Inc., Alaska, USA  
 2011-2014. Developed Rare Earth Element (REE) purification processes for Ucore.  
 2011-2013. Defined Nitric Acid Recycling for Acidic Liquors at Bokan AK REE mine.  
 2011-2012. Developed Nitric Acid Extraction Process for solubilizing REE from Ucore's ore  
 2009 Founder and CEO, IntelliMet LLC, Missoula, MT  
 1996-2009 President, ChelaTech, Inc., Missoula, MT, and Alameda, CA.  
 1994-present President, Hammen Corporation. Missoula, MT  
 1994-1997 Acting President, Consultant, ChromatoChem, Inc., Missoula, MT  
 1987-1998 Faculty Affiliate, University of Montana, Missoula, MT, Chemistry Department.  
 1986-1997 Faculty Affiliate, University of Montana. Missoula, MT, Biology Department.  
 1985-1994 President, ChromatoChem, Inc., La Canada, CA and Missoula, MT  
 1982-1986 Director, Chemistry Department, Vestar Research, Jnc. (now NEXSTAR, NASDAQ), Pasadena, CA  
 1980-1986 Molecular Biologist and Analytical Chemistry Laboratory Director, California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA  
 1978-1980 Molecular Biologist, Bio-Organic Chemistry Laboratory, SRI International, Menlo Park, CA.  
 1976-1978 Research Associate, Molecular Biology Institute, UCLA, Los Angeles, CA  
 1976-1977 Postdoctoral Scholar, Department of Chemistry, UCLA, Los Angeles, CA  
 1973-1976 United States National Cycling Team; competed in World Championships, Pan American Games, and other International level cycling events  
 1972-1973 Postdoctoral Fellow, Department of Chemistry, UCLA, Los Angeles, CA  
 1966-1972 Graduate Student, Department of Chemistry, University of Wisconsin, Madison, WI.  
 Dr. Hammen was in the laboratory of Professor Barry M. Trost, now at Stanford.

### PUBLICATIONS (truncated)

-Hammen, R.F., Pang, D.C., Van Der Sluys, L.S., Judd, R.C., and Loftsgaarden, E., 1993. Acid Mine Water Processing and Metal Recovery by Fast Solid Phase Extraction. Mining Engineering.  
 -Hammen, R.F., Pang, D.C., Van Der Sluys, L.S., Cook, C.G., and Loftsgaarden, E., 1993. Fractionation and Recovery of Toxic Metals from Complex Wastewater. EPD Congress 1993, ed.J.P. Hager, (Warrendale, PA:The Minerals, Metals and Materials Society, 1993), 3-19.

- Hammen, R.F., Pang, D.C. and Cook, C.G., 1993. Fast Solid Phase Extraction of Metals from Water. Proceedings of HAZMACON '93, eds. T. Bursztynsky and M.L. Loss, (Oakland, CA: Association of Bay Area Governments, 1993), 740-750.
- Hammen, R.F., Pang, D.C., Van Der Sluys, L.S., Cook, C.G., and Loftsgaarden, E., 1993. High Performance Chelation Chromatography: Capture Kinetics of Heavy Metals. PITTCON '93, Atlanta, GA
- Hammen, R.F., Pang, D.C. and Loftsgaarden, E., 1993. Extraction and Recovery of Mercury from Wastewater. 1993 Summer National American Institute of Chemical Engineers Meeting, Seattle, WA.
- Hammen, R.F., High Velocity Extraction of Metal Cyanides from Water, Air & Waste Management Association's 90<sup>th</sup> Annual Meeting & Exhibition, June 8-13, 1997, Toronto, Ontario, Canada
- ChromatoChem, Inc., Resource Recovery Project Technology Demonstration Final Report for ChromatoChem, Inc.'s Chelation Chromatography Process, Prepared by ChromatoChem, Inc., IT Corporation, and MSE Technology Applications, Inc., Prepared for U.S. Department of Energy, Federal Energy Technology Center, Pittsburgh, PA 15236, Contract No. DE-AC22-96-EW96405., 1998
- Hammen, R.F., and Hammen, J.P., 1999, High Performance Extraction of Chromate Ions with Tethered Metal-Selective Ligands, Remediation Technology Conference, The Environmental Protection Agency, Bloomingdale, IL, November 2-4.
- Hammen, R.F., and Hammen, J.P., 2000, Selective High Performance Extraction of Heavy Metals with Tethered Metal-Selective Ligands, ACHEMA, Frankfurt, Germany, May 21-26.
  
- Hammen, R.F., "Selective Recovery of Metal Ions with High Throughput Nano-Extraction", Global Uranium Symposium, Corpus Christi TX, April 21, 2007
  
- Hammen, R.F. and Hammen, J.P. , 2010. "Value-added Recovery of Vanadium, Moly, and Rhenium from ISL Solutions". Third International Conference on Uranium, Saskatoon, SK, August 18, 2010
  
- Hammen, R.F., and Hammen, J.P., 2012 "Rapid Separation of Rare Earth Elements with Interstitial Polymer Network Ion Exchange Columns", 2012 TMS Meeting, March 11-15, 2012; Orlando FL USA.
  
- Lifton, J., and Hammen, R.H., 2012 "The State of the Art in Separating and Purifying the Heavy Rare Earths: Solvent Exchange, Ion Exchange, and Solid Phase Extraction, Which is the Optimal Process?". COM 2012 - 51st Annual Conference of Metallurgists Sept. 30-Oct. 3, 2012, Niagara Falls, ON, Canada.
  
- Lifton, J., Hammen, R., "Building the Mine of the Future: Using SPE Technology to Develop a New Rare Earth Production Paradigm at Bokan, Alaska, COM 2013, Montreal, Quebec, October 30, 2013
  
- Hammen, R.F., 2018, Production of Purified Lithium Salts with a One-Stage Solid Phase Extraction (SPE) System, Extraction 2018, Ottawa, Canada, August 26–29.
  
- Hammen, R.F., Hammen, J.P., and Hammen, C.R. "Design of a Solid-Phase Extraction Plant to Purify Rare Earth Elements by High-Performance Chelation Chromatography (HPCC)" Chapter 10 in the monograph "Critical and Rare Earth Elements", CRC Press, Abhilash and Ata Akcil, editors, December, 2019.

#### **United States Patents.**

- Hammen; Richard F. (Missoula, MT), Chromatographic material, United States Patent 5,240,602, August 31, 1993.
  
- Hammen; Richard F. (Missoula, MT), Process for separating a substance from a mixture, United States Patent 6,251,278, June 26, 2001.
  
- Hammen; Richard F. (Missoula, MT), Hammen; John P. (Missoula, MT), Tethered polymer ligands, United

States Patent 6,689,715, February 10, 2004.

Hammen; Christopher R. (Missoula, MT), Hammen, Richard F. (Missoula, MT), Composites incorporating covalently bonded interstitial polymer resins, United States Patent 6,916,536, July 12, 2005.

Hammen; Richard F. (Missoula, MT), Hammen; John P. (Missoula, MT), Composite matrices with interstitial polymer networks, United States Patent 6,946,070, September 20, 2005.

Hammen; Richard F. (Missoula, MT), Hammen; John P. (Missoula, MT), Composite matrices with interstitial polymer networks, United States Patent 7,201,844, April 10, 2007

Hammen; Richard F. (Missoula, MT), Hammen; John P. (Missoula, MT), Tethered polymer ligands, United States Patent 7,220,703, May 22, 2007.

**Small Business Innovation Research Grant Support (partial list).**

2 R44 RR14158-28A1                      Hammen (PI)                      10/01/2001 – 09/30/2003  
NIH Phase II  
Composite Supports for High Throughput Chromatography  
Develop composite High Pressure Liquid Chromatography columns for protein separations, using interstitial polymer networks.  
Role: PI

DAMD17-03-C-0027                      Hammen (PI)                      12/13/2002 – 05/13/2003  
DoD  
Rapid Serological Diagnosis of Scrub Typhus Infections  
Develop devices for two-step rapid immunoassay of antibody against scrub typhus infection.  
Role: PI

DMI-0060702                              Hammen (PI)                      01/01/2001 – 06/30/2001  
NSF  
High Throughput, Ion Selective Metal Separation Composites  
Preparation of metal extraction columns with tethered metal-selective ligands.  
Role: PI

DMI-9961206                              Hammen (PI)                      01/01/2000 – 06/30/2001  
NSF  
Advanced Catalysts with Tethered Metal-Ligand Complexes: Development of catalysts with tethered chelating ligands.  
Role: PI

EP-D-10-031                              Hammen (PI)                      01/01/2010 – 07/31/2010  
EPA  
Economic Capture of CO<sub>2</sub> with Amines and Ionic Liquids Tethered in the Gas Phase