



## MODERN ELECTRO/THERMOCHEMICAL ADVANCES IN LIGHT-METAL SYSTEMS Teaming List

**Updated: May 3, 2013**

This document contains the list of potential teaming partners for the MODERN ELECTRO/THERMOCHEMICAL ADVANCES IN LIGHT-METAL SYSTEMS, solicited in RFI-000002 and is published on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov>), ARPA-E's online application portal. This list will periodically undergo an update as organizations request to be added to this teaming list. If you wish for your organization to be added to this list please refer to <https://arpa-e-foa.energy.gov> for instructions. **By enabling and publishing the MODERN ELECTRO/THERMOCHEMICAL ADVANCES IN LIGHT-METAL SYSTEMS Teaming List, ARPA-E is not endorsing or otherwise evaluating the qualifications of the entities that are self-identifying themselves for placement on this Teaming List.**

Organization	Name	Organization Type	Area of Expertise	Background	Website	Email	Phone	Address
Abengoa Solar	Luke Erickson	Business < 500 Employees	Renewable power (non-bio)	Abengoa Solar is a global leader in concentrating solar power from R&D through plant development, construction, and operation. We have built and operated test facilities and commercial scale plants utilizing our power tower and parabolic trough technologies. Using our technologies and capabilities, we have the abilities to provide technical and construction solutions for process heat and electrical production needs. Specifically related to this announcement, Abengoa Solar has recently been developing a power tower technology using light metals which undergo a solid-liquid phase change as the heat transfer and thermal energy storage material. Through this project, we have developed strengths in handling molten metals at very high temperatures in solar receivers, transfer systems, storage tanks, and heat exchangers. For more information, see <a href="http://arpa-e.energy.gov/?q=arpa-e-projects/conversion-tower-dispatchable-solar-power">http://arpa-e.energy.gov/?q=arpa-e-projects/conversion-tower-dispatchable-solar-power</a> .	<a href="http://www.abengoasolar.com/">http://www.abengoasolar.com/</a>	luke.erickson@solar.abengoa.com	303-323-9094	11500 W 13th Ave, Lakewood CO 80215
Adherent Technologies, Inc.	Ronald E. Allred	Business < 500 Employees	Other	Prototype recycling reactors for scrap electronics, composites, and mixed plastics. Electrochemical separation of recovered metals from scrap electronics. General chemical laboratories and characterization instrumentation.	<a href="http://www.adherent-tech.com">www.adherent-tech.com</a>	rallred@adherent-tech.com	505-346-1688	11208 Cochiti SE, Albuquerque, NM 87123

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Alcoa Inc.	Srinivas S Garimella	Business > 1000 Employees	Other	Alcoa today is the world's leading integrated aluminum producer. Since inventing the modern-day aluminum industry more than 120 years ago, Alcoa innovation has been behind major milestones in the aerospace, automotive, packaging, building and construction, commercial transportation, defense, consumer electronics and industrial markets. Alcoa maintains a healthy corporately funded R&D program by annually investing approximately \$250M of its revenues in R&D; primarily at Alcoa's four internal R&D facilities. Alcoa was granted or maintained 1,874 patents in 2011. Alcoa utilizes these facilities to improve its own processes, characterize its products, and perform design/development work with major partners, including DoD, DOE, DARPA, and other government agencies. Alcoa interests under this RFI "Thermo/Electrochemical Metals Extraction" are as follows: Metallurgy Thermo chemistry High Temperature Materials Thermal Engineering Metals Recycling Materials Science Process Engineering	www.alcoa.com	Srinivas.Garimella@alcoa.com	724-337-5778	100 Technical Drive Alcoa Center Pa. 15069
Auburn University	Jay M. Khodadadi	University	Other	Proven record of math. & physical modeling of liquid metal systems for >25 yrs. Specific to this FOA, a water model of liquid aluminum flow in an existing tundish and proposed changes to it were designed, built and tested for a major metal-producing company. Experiments included laser sheet, surface powder, tuft grid techniques & LDV measurements. Working on thermal conductivity of phase change materials (PCM), the applicant leads a multi-campus DOE-sponsored project on Nanostructure-enhanced PCM (NePCM). The core expertise of thermal energy storage and waste heat recovery is blended with nanotechnology (www.eng.auburn.edu/nepcm). Basic science and applied aspects of NePCM are addressed by mech./chem./mat. engineers & chemists. EXPERTISE: applied phys., thermal storage, heat capture, heat exchanger design, thermal eng., renewable energy, solar thermal eng., transport phenomena, process eng.	http://www.eng.auburn.edu/nepcm	khodajm@auburn.edu	(334) 844-3333	1418 Wiggins Hall, Auburn, AL 36849-5341
Case Western Reserve University	David Schwam	University	Other	metallurgy; thermochemistry; high temperature materials; heat capture; heat exchanger design; thermal engineering; metals recycling; materials science; and process engineering.	http://engineering.case.edu/groups/CMPL/	dxs11@case.edu	2163686499	Dept. of Materials Science and Engineering, White #402, 10900 Euclid Ave, Cleveland, OH 44106

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Clean Energy Research Center, Univ. So. Fl.	Yogi Goswami	University	Other	We have expertise in the areas of: high temperature thermal storage; heat capture; heat exchanger design; thermal engineering; renewable energy; solar thermal engineering; spectroscopy; transport phenomena; materials science and process engineering; metallurgy; electrochemistry; thermochemistry; chemical engineering; and high temperature materials.	<a href="http://cerc.eng.usf.edu/">http://cerc.eng.usf.edu/</a>	goswami@usf.edu	813-974-0956	4202 E. Fowler AVenue, M.S. ENB 118, Univ. So. Fla., Tampa, FL 33620
Czero	Guy Babbitt	Business < 500 Employees	Transportation	Czero is a premier engineering service company that specializes in working with startup companies to accelerate new technology development in the areas of clean tech, automotive and hydraulic systems. Our strength lies in our ability to take our clients rough idea and work with their team to quickly and cost effectively generate robust prototypes to demonstrate proof of concept, yet are applicable to high volume production. We are an analytically based company and have the capability to do detailed analysis work such as FEA, CFD, dynamic simulations, magnetic modeling, high bandwidth hydraulic simulation, electronic controls, 3-d solid modeling (CAD) work, make prints and use GD&T.. We combine those skills with strong hands on experience and hard work to rapidly develop new technologies and IP for our customers. We are currently working on another ARPA-E project	<a href="http://www.czero-solutions.com">www.czero-solutions.com</a>	guy.babbitt@czero-solutions.com	(719) 331-9662	320 E Vine Drive, Suite 325 Fort Collins, CO 80524
Energy Research Company	Robert De Saro	Business < 500 Employees	Other	Our specialties are in real time, in-situ measurement of melt chemistries and other innovative technologies involving recycled metals. We are a small business and have worked extensively with government funding agencies such as DOE, DOD, NSF, DOC, and DHS. We would be interested in companies that can add to our technology base especially in regards to the upcoming ARPA-E FOA. We would also be interested in other funding mechanisms to propel our technologies into the commercial marketplace.	<a href="http://www.er-co.com">www.er-co.com</a>	rdesaro@er-co.com	(908) 561-8110 x21	1250 South Ave., Plainfield, NJ 07062
Florida International University (FIU)	Yiding Cao	University	Other	Capabilities in the Focus Areas of renewable energy/solar thermal engineering/high temperature thermal storage include: Concentrating solar receivers for metal-extraction thermochemical reactors, effective high-temperature heat transfer from the solar receiver to the reaction sites in the reactor, thermal energy storage to enable continued operation of metal extraction processes, and high temperature heat pipes/energy storage for metal-extraction applications. Capabilities in the Focus Areas of heat capture/heat exchanger design/thermal engineering include: High-temperature heat transfer, heat recovery and heat recuperation, high-temperature heat exchanger designs, and heat pipe heat exchangers.	<a href="http://www.me.fiu.edu/faculty/yiding-cao/">http://www.me.fiu.edu/faculty/yiding-cao/</a>	caoy@fiu.edu	305-348-2205	10555 W. Flagler Street, Miami, Florida 33174

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Halotechnics, Inc	Justin Raade	Business < 500 Employees	Other	An ARPA-E awardee under the High Energy Advanced Thermal Storage (HEATS) program, Halotechnics is the industry leader in high temperature fluids and engineering systems for thermal storage. Our molten salt and molten glass materials are operable over 250-750 and 400-1200 °C, respectively, and are thus well matched to Al, Mg, and Ti processing temperatures. By synthesizing and characterizing over 22,000 distinct candidate fluids, Halotechnics has developed expertise in finely tuning materials to meet a wide array of physical property requirements. We have subsequently leveraged our breakthrough materials science technology to design and test custom-built storage tanks, pumps, heat exchangers, piping, and sealing. Halotechnics is seeking an METALS partnership with metallurgy experts and industrial metals producers to apply our proficiency in high temperature heat transfer fluids and thermal storage systems.	www.halotechnics.com	jraade@halotechnics.com	(510) 547-2634	5980 Horton St, Suite 450, Emeryville, CA 94608
IND LLC	Neale R. Neelamegham	Business < 500 Employees	Other	IND LLC is a Process Technology development and licensing company - with a consortium of experts in the field of light metals such as magnesium, titanium, aluminum, and lithium, boron and other rare metals. We provide processes for the related chemicals prevalent in these metal production. Process technology developed includes energy storage [such as solar thermal storage, battery technology, etc] and generation for renewable energy including carbon dioxide reduction metallurgy making fuels and energy efficiency improvement technologies and Near-Zero Effluent processes, needed in making Sustainable, low cost production in the 21st Century. IND LLC is geared to provide tailor made Process solutions to fit the customers needs and resources.	www.ind-llc.com	indllc@inbox.com	8012533592	9859 Dream Circle, South Jordan, UT 84095
IUPUI	Peter J. Schubert, Ph.D., P.E.	University	None of the above	Simultaneous extraction of multiple isotopes. Three US patents granted and active. NASA SBIR research funded. Works on poor ore bodies.	LugarEnergyCenter.org	pjschube@iupui.edu	3172780812	799 W. Michigan St., ET 215D, Indianapolis, IN 46202
Los Alamos National Laboratory	Timothy Foley	Federally Funded Research and Development Center (FFRDC)	Other	We have the capability to handle applied physics, high temperature processes, thermochemistry, from bench top to pilot plant scale processes. We also handle chemical processes that encompass all types of materials. Additionally, we have world class expertise in high and low pressure systems, common and exotic metallurgy and industrial processes.	www.lanl.gov	tfoley@lanl.gov	505.231.8922	MS J564, LANL, Los Alamos, NM 87544

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Materials & Electrochemical Research (MER) Corporation	Dr. James C. Withers	Business < 500 Employees	Other	Domestic ore to produce titanium at low cost. Domestic ore to produce aluminum as a powder at reduced cost well under Hall-Heroult. Electrolytic extraction of titanium and titanium alloys on a continuous basis at lower cost than Kroll sponge. Renewal energy concept to produce Ti and Al. Utilization of Ti sponge or scrap to directly produce alloy componentry at a cost of 2 to 5 times the feed cost. MER was a DARPA Initiative in Titanium recipient that demonstrated continuous pilot/commercial electrolytic production of titanium and titanium alloy powder in large powder sizes at a projected cost less than Kroll sponge. MER demonstrated producing Ti-6Al-4V and other alloy powders in large powder sizes from domestic ore sources using metallothermic reduction. MER demonstrated producing titanium armor plate for under \$10/lb. TiCl4 was produced from domestic ore sources at low temperatures of 350-400°C at low cost. MER is open for partnering.	www.mercorp.com	jcwithers@mercorp.com	520-574-1980	7960 S. Kolb Road, Tucson, Arizona 85756-9237
Oak Ridge National Laboratory	William Peter	Federally Funded Research and Development Center (FFRDC)	Other	Oak Ridge National Laboratory has been performing research and development studies on the consolidation of titanium powders synthesized through new reduction technologies for almost ten years. ORNL has a long list of manufacturing and characterization capabilities suited for titanium consolidation, melting, and processing.	www.ornl.gov/manufacturing	peterwh@ornl.gov	865-241-8113	One Bethel Valley Rd. MS-6083, Oak Ridge, TN 37831
Phinix , LLC	Dr. Subodh Das	Business < 500 Employees	Other	Demonstrated expertise and concepts in: 1.Alternative aluminum production processes 2.Recycling and sorting of light metals scrap 3.Development and production of recycle-friendly alloys 4.Commercialization of ideas from conception to market place 5. Management of large multidisciplinary projects with industrial,academic and DOE lab partners	www.phinix.net	skdas@phinix.net	859-619-8386	1500 Bull Lea Road ,Suite 206 , Lexington, KY 40511
Sandia National Laboratories	Alyssa Christy	Federally Funded Research and Development Center (FFRDC)	Other	Electrochemical reduction of alkali and transition metal systems (including Al, Mg, Ti, & TiH); nonaqueous redox chemistry; complex organometallic synthesis and characterization; metal alkoxide chemistry, synthesis, and characterization; molten salt electrochemistry of metal complexes, analytical electrochemistry from mm to um, electrochemical process simulation; high temperature sensors and process monitoring; liquid metal alloy synthesis and characterization; simulation and experimental capability in high rate heating and cooling of metals and metal salts; synthesis and characterization of nanostructured alloys and compounds; reactor design; simulations of continuous flow manufacturing; modeling of manufacturing processes; high performance computing; advanced design and fabrication facilities for power electronics, novel sensors, and high temperature compatible process monitors; TOF-SIMS, XPS, AC-TEM, TEM, SEM, Auger, RBS, ERD, NMR, FTIR, Raman, UV-Vis, EDS, RHEED, LEED.	energy.sandia.gov	ajchris@sandia.gov	505-844-4542	Po Box 5800 MS 1421 Albuquerque, NM 87185

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Sandia National Laboratories	William A. Averill	Federally Funded Research and Development Center (FFRDC)	None of the above	The Power Sources Technology Group of the Sandia National Laboratories has developed unique capabilities in the area of electrochemical processing of reactive materials such as light metals (Al, Mg, Ti, & TiH). In addition, Sandia has world-class analytical, prototyping, and modeling facilities.	<a href="http://www.sandia.gov">http://www.sandia.gov</a>	waaveri@sandia.gov	505-284-7881	P. O. Box 5800, Albuquerque, NM 87185-0614
Solidia Technologies, Inc	Richard E. Riman	Business < 500 Employees	Other	Solidia is a company that utilizes carbon dioxide to make products for building and infrastructure (roads, bridges) applications. The interest in the METALS program is to partner with metal manufacturing companies that wish to reduce their carbon footprint, which is an important consideration to the METALS program. Solidia can reduce the carbon footprint of a metal manufacturer utilizing waste CO <sub>2</sub> , energy and by-products of metal manufacture to create green sustainable enterprises.	<a href="http://www.solidiatech.com/">http://www.solidiatech.com/</a>	riman@solidiatech.com	609-947-3325	CCR106, 607 Taylor Road, Piscataway, NJ 08854
SRI International	Barbara Heydorn	Non-Profit	None of the above	SRI International has materials science, engineering, and process scale-up expertise relevant to the extraction and recycling of light metals. Our staff of 2,100 work in partnership with clients to invent, scale-up and commercialize promising technologies developed by SRI, brought to us by clients, or developed in partnership with clients. Our laboratories are equipped with high temperature furnaces and a full array of techniques for ore and metal characterization including chemical composition, metallography, mechanical and chemical properties. SRI has facilities to measure and model the thermodynamic properties of systems at high temperatures. Examples of technologies SRI has developed include production of Ti alloy powders, titania from ilmenite, Ti by reduction of TiCl <sub>2</sub> with Na, and extraction of Ti from CaTiO <sub>3</sub> . SRI also developed processes to produce thermal accumulators from a waste product of Al production. SRI's electroadhesion technology can be used for metals sorting.	<a href="http://www.sri.com">www.sri.com</a>	energy-center@sri.com	650 859 5717	333 Ravenswood Ave., Menlo Park, CA 94025
Texas A&M University	Hong Liang	University	Other	Synthesis of nanomaterials and characterization, tribology and tribochemistry	<a href="http://liang.tamu.edu">http://liang.tamu.edu</a>	hliang@tamu.edu	9798622623	M.S. 3123, Mechanical Engineering, Texas A&M University



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The Ohio State University	Sudarsanam Suresh Babu	University	Transportation	NSF I/UCRC center that operates in 4 universities (OSU, Lehigh, Wisconsin and Colorado School of Mines) and 29 member companies related to energy applications. The portfolio of research projects includes light metal (Ti and Al) development with due consideration of manufacturing routes including joining and additive manufacturing processes for energy industries. The expertise and capability includes innovative processes (e.g. laser based processes, ultrasonic additive manufacturing, collision welding), advanced ex-situ and in-situ characterization (electron microscopy, non destructive evaluation, thermo-mechanical physical simulations), and integrated computational materials engineering (process-microstructure-performance).	<a href="http://materials.joining.osu.edu/cimjsea/CIMJSEA/Welcome.html">http://materials.joining.osu.edu/cimjsea/CIMJSEA/Welcome.html</a>	babu.13@osu.edu	614-247-0001	1248, Arthur E Adams Drive, Columbus, Ohio - 43221
UHV Technologies, Inc.	Nalin Kumar	Business < 500 Employees	Offline or Online characterization for fast monitoring and prediction	We are a high technology small company specializing in nanotechnology based product development and are currently developing an advanced X-ray Fluorescence (XRF) technology for mercury emissions monitoring with DOE funding. This technology can also be used for offline and online sorting of light and other metals. Our technology incorporates a innovative high throughput x-ray source combined with individual linear arrays of XRF detectors for high speed in-line sorting. We are also one of the premier suppliers of XRF calibration standards in the world ( <a href="http://www.nanoXRF.com">www.nanoXRF.com</a> ).	<a href="http://www.nanoRanch.com">www.nanoRanch.com</a>	kumarmaple@anol.com	817-880-3880	817-880-3880
University of Florida	Nicholas AuYeung, Ayyoub Mehdizadeh Momen	University	Renewable power (non-bio)	50 kW Solar Simulator for experimentation of high temperature thermochemical processes	Mechanical and Aerospace Engineering	nauyeung@ufl.edu	8608031520	PO Box 116250 Gainesville, FL 32611-6250
University of Nevada Reno	Dev Chidambaram	University	Other	Expertise in electrochemistry and surface analysis - spectroscopy (Raman, FTIR, XPS, UV-Vis, SIMS, and synchrotron-based techniques); Corrosion; specialized facility for evaluation of materials under supercritical water conditions and up to 600 deg C and 30MPa;	<a href="http://www.electrochemical.org">www.electrochemical.org</a>	dcc@unr.edu	775-784-7066	1664 N Virginia St, Univ of Nevada Reno, MS0388, Reno, NV 89557-0388