

## Vitae

### Henry E. Cardenas

Associate Professor of Mechanical Engineering and Nanosystems Engineering  
Jack T. Painter Endowed Professor of Civil Engineering  
Director, Applied Electrokinetics Laboratory  
Research Associate, Center for Biomedical Engineering and Rehabilitation Science

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#### Education

2002: Ph.D. in Civil Engineering, University of Illinois at Urbana-Champaign (UIUC).

1994: M.S. in Civil Engineering, UIUC.

1989: B.S. in Engineering Mechanics, UIUC.

#### Academic Experience

2009 to Present: Associate Professor of Mechanical and Nanosystems Engineering,  
Louisiana Tech University

2003 to 2009: Assistant Professor of Mechanical Engineering, Louisiana Tech  
University

1987-89: Research assistant in the Railway Wheel Lab at the University of  
Illinois at Urbana-Champaign.

#### Industrial and Government Research Experience

1994 to Present: Industrial Consultant, Tri-Car Technologies, Urbana IL, and  
Ruston, Louisiana.

1998 to 2002: Director of Research and Development at Gill Acquisitions in  
Urbana, Illinois.

1989-1998: Principal Investigator in the Corrosion and Coatings Team of the  
Material Science and Technology Division at the U.S. Army  
Construction Engineering Research Laboratories (CERL) in  
Champaign, Illinois.

#### Honors, Awards, and Recognition

2010 NASA Kennedy Space Center Summer Research Faculty Fellowship

2010 International Conf. on SCMT Outstanding Paper Selection: Corrosion Mitigation  
in Mature Reinforced Concrete using Nanoscale Pozzolan Deposition, 2<sup>nd</sup> Int.

- Conf. on Sustainable Construction and Materials Technologies (SCMT) -  
Awarded to top 12 out of 360 submissions.
- 2009: NASA Kennedy Space Center Summer Research Faculty Fellowship.
- 2008: WMSCI Best Session Paper: Modeling and Simulation of Electromutagenic Processes for Multiscale Modification of Concrete”, Session entitled “Applications of Informatics and Cybernetics in Science and Engineering” of the 12<sup>th</sup> World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI) 2008.
- 2008: NASA Kennedy Space Center Summer Research Faculty Fellowship.
- 2007: Jack T. Painter Endowed Professorship in Civil Engineering.
- 2006: College of Engineering and Science Research Award, Louisiana Tech University.
- 2006: Louisiana Tech University Engineering and Science Foundation Award of Excellence.
- 2006: Max P. Watson Sr. Professorship in Mechanical Engineering, 2006
- 2002: Carbon Fx vaulting pole design used to achieve top 2 world record heights for the year.
- 2002: OTE UHM Discus design used to set women's American record.
- 2001: Slimline Throwing weight design used to win NCAA Championships in 2001 and 2002, and set both men's and women's NCAA records. Technology banned from 2003 competition under revised NCAA rules.
- 1996: USACERL Year of Advanced Study Award, fellowship which provided a full year of graduate study concurrent with full salary.
- 1995: U.S. Army R&D Award nomination for development of the In Situ Pipe Coating Worm.
- 1994: U.S. Army Sustained Superior Performance Award., 1992-1994.
- 1993: U.S. Army Sustained Superior Performance Award.
- 1992: U.S. Army Sustained Superior Performance Award.
- 1992: U.S. Army Award of Excellence, 1992.

1992: U.S. Army On-the-Spot incentive award for development of environmentally sustainable materials.

1986: Engineering Open House Project Award, University of Illinois at Urbana-Champaign.

1983: National Honor Society, Mt. Vernon, Township High School, 1983.

### **Teaching**

MEMT 201: Engineering Materials

MENT 361: Advanced Mechanics of Materials

MEMT 450C: Durability of Materials

MEEN 411: Modern Engineering Materials

MEEN 511: Advanced Engineering Materials

### **Journal Publications**

Cardenas, H., Kupwade-Patil, K., Eklund, S., “Corrosion Mitigation in Mature Reinforced Concrete using Nanoscale Pozzolan Deposition”, American Society of Civil Engineers – Journal of Materials in Civil Engineering, Accepted, August, 2010.

Cardenas, H., Kupwade-Patil, K., Eklund, S., “Recovery from Sulfate Attack in Concrete via Electrokinetic Nanoparticle Treatment”, American Society of Civil Engineers – Journal of Materials in Civil Engineering, Accepted, December, 2010.

Kanno, J., Richardson, N., Philips, J., Mainardi, D., Cardenas, H., “Modeling and Simulation of Electromutagenic Processes for Multiscale Modification of Concrete”, J. of Systemics, Cybernetics and Informatics, Vol. 7, No. 2, pp. 69-74, 2009.

Tully-Darthez, S.R., Cardenas, H.E., Sit, “P.S. Pore Characteristics of Chitosan Scaffolds Studied by Electrochemical Impedance Spectroscopy” J. Tissue Engineering: Part C. In press, 2009.

Cardenas, H., Struble, L., *Modeling of Permeability Reduction in HCP via Electrokinetic Nanoparticle Treatment*, American Society of Civil Engineers – Journal of Materials in Civil Engineering, Vol. 20, No. 11, Nov. 2008.

Cardenas, H. E., Syed, F., Eklund, S. E., *Electromutagenic Process Permits High Current Density for Lithium Transport in Concrete*, J. Construction and Building Materials, submitted July 2008.

Cardenas, H. E., Kupwade-Patil, K., Ramakrishna, K., *Galvanically Assisted Crevice of Electroplated Press Cylinders*, J. Corrosion Engineering, Science and Technology., Vol. 42, No. 4, pp. 363-370, Nov. 2007.

Cardenas, H., and Struble, L., “Electrokinetic Nanoparticle Treatment of Hardened Cement Paste for Reduction in Permeability” American Society of Civil Engineers Journal of Materials in Civil Engineering, Vol. 18, No. 4, July/August 2006.

Cardenas, H., “Hammer Throw: Analysis of Hammer Handle Performance and Safety”, New Studies in Athletics, International Amateur Athletic Federation Publications, Great Britain, Vol. 18, Part 1, pp. 47-52, 2003.

Cardenas, H., “Edmonton Hammer Handle Study.” Track and Field Coaches Review, International Coaches Federation, pp. 105-110, Sept. 2003.

### **Conference Papers:**

Cardenas, H., Kupwade-Patil, K., Eklund, S., “Corrosion Mitigation in Mature Reinforced Concrete using Nanoscale Pozzolan Deposition”, Proceedings, Second International Conference on Sustainable Construction Materials and Technologies, Universtia Politecnica Delle Marche, Ancona, Italy, June, 2010.

Cardenas, H., Alexander, J., Kupwade-Patil, Calle, L.M., “Field Testing of High Current Density Electrokinetic Nanoparticle Treatment for Corrosion Mitigation in Reinforced Concrete”, Proceedings, Second International Conference on Sustainable Construction Materials and Technologies, Universtia Politecnica Delle Marche, Ancona, Italy, Accepted for publication, June, 2010.

Cardenas, H., Paturi, P., Dubasi, P., “Electrokinetic Treatment for Freezing and Thawing Damage Mitigation within Limestone”, Proceedings of Sustainable Construction Materials and Technologies, Coventry England, 12 June 2007.

Jordan, W., Cardenas, H., and O’Neal, C., “Using a Materials Concept Inventory to Assess an Introductory Materials Class: Potential and Problems, Proceedings of the 2005 American Society of Engineering Education Annual Conference and Exposition, Portland Oregon, June 2005.

Sit, S., Tully, S., and Cardenas, H., “Chitosan Scaffold Characteristics Measured by Electrochemical Impedance Spectroscopy”, Proceedings of the 2007 Biomedical Engineering Society Annual Meeting, 27 Sept. 2007.

Cardenas, H., Kupwade-Patil, K., “Corrosion Remediation using Chloride Extraction Concurrent with Electrokinetic Pozzolan Deposition in Concrete”, Proceedings of the 6<sup>th</sup> Symposium on Electrokinetic Remediation, Vigo Spain, 14 June 2007.

Cardenas, H., Paturi, P., Dubasi, P., “Freeze-Thaw Damage Repair in Limestone using Electrokinetic Treatment”, Proceedings of the 6<sup>th</sup> Symposium on Electrokinetic Remediation, Vigo Spain, 14 June 2007.

Cardenas, H., Satya, S., Zhao, Y., Morishetti, Deepika, “Electrochemical Processing of Bone Repair Agents”, Proceedings of the 6<sup>th</sup> Symposium on Electrokinetic Remediation, Vigo Spain, 14 June 2007.

Gordon, K., Lee, L., Cardenas, H., “Improving Reinforced-Concrete Infrastructure using Electrokinetic Treatments and FRP Rehabilitation”, Proceedings of the Society for the Advancement of Material and Process Engineering”, 3 June 2007.

Cardenas, H., Vasam, S., Morisetti, D., and Zhao, Y., “Electrokinetic Transport and Processing of Bone Repair Agents”, Houston Biomedical Materials Research Conference, February 2007.

Cardenas, H. and Goli, N., “Investigation of Electrokinetic Nanoparticle Technology for Corrosion Mitigation in Reinforced Concrete”, American Concrete Institute, Proceedings of Concrete Solutions, St. Malo, Brittany, France, June, 2006.

Cardenas, H., “Concrete Restoration via Electrochemical Strategies”, Rebuilding the South in the Wake of Hurricanes Rita, Katrina, and Ivan, conference held at Tuskegee University, Tuskegee Alabama, co-sponsored by the Department of Energy and the World Council of Majors, January 2006.

Cardenas, H., Zhao, Y., Kalapala, P., Goli, N., “Strength Enhancement of Concrete via Electrokinetic Nanoparticle Treatments”, American Concrete Institute Spring Meeting, Research in Progress, April 2005.

Cardenas, H., Szeliga, M., and Bushman, J., “Electrochemical Corrosion Assessment of Navigation Structures”, Proceedings of the U.S. Army Corps of Engineers Electrical/Mechanical Conference, March 1998.

Hock, V. F., Cardenas, H., Smothers, K., and Mc Leod, M., “Mitigation of Lead Solvancy in Building Plumbing”, FY 95 Electrical Mechanical Training Conference, Waterways Experiment Station, Vicksburg, MS, February 1995.

Hock, V. F., Knoll, R., Cardenas, H., Myers, J., Mc Leod, and J. McCarty, J., “State-of-the-Art Anti-Scale/Corrosion Resistant Coatings”, FY 95 Electrical Mechanical Training Conference, Waterways Experiment Station, Vicksburg, MS, February 1995.

Hock, V. F., Knoll, R., and Cardenas, H., “Experimental Heat and Mass Transfer Modeling of the Corrosion Process”, Proceedings, U. S. Army Science Conference, Paper IOP2, June 1994.

Cardenas, H. and Segan, E., "Improvement of Pipe Flow Characteristics in Small Diameter Pipe due to In Situ Rehabilitation", Proceedings, International Pipeline Rehabilitation Seminar, Houston, Texas, February 1993.

Cardenas, H., Szeliga, M., and Bushman, J., "On-Site, Electrochemical, Corrosion Assessment of Sheet Pile Navigation Structures." Proceedings, Infrastructure Condition Assessment: Art, Science, and Practice, M. Saito, Ed., American Society of Civil Engineers, Boston, MA, pp. 534-543, August 1997.

Cardenas, H., Hock, F. V., Segan, E., "Feasibility of In Situ Rehabilitation of Small Diameter Heat Distribution Plumbing." Paper 95606, Proceedings, National Association of Corrosion Engineers, Corrosion 95, Baltimore, MD, March 1995.

Cardenas, H., Hock, V. F., Emery, J., "In Situ Pipe Coating Device." Paper 95607, Proceedings, National Association of Corrosion Engineers, Corrosion 95, Baltimore, MD, March 1995.

Hock, V. F., Cardenas, H., Zelsdorf, E., Smothers, K., and Anderson, J., "Corrosion Control Study of a Typical Large Drinking Water System." Paper 95608, Proceedings, National Association of Corrosion Engineers, Corrosion 95, Baltimore, MD, March 1995.  
Hock, V. F., Knoll, R., Cardenas, H., and Myers, J., "State-of-the-Art Anti-Scale/Corrosion Resistant Coatings." Paper 93515, Proceedings, National Association of Corrosion Engineers, Corrosion 93, March 1993.

Hock, V. F., Cardenas, H., Sear, E., Knoll, R., "Experimental Heat Transfer Model for Optimizing Heat Exchanger Tubing." Paper 93515, Proceedings, National Association of Corrosion Engineers, Corrosion 93, March 1993.

### **Technical Reports**

Cardenas, H.E., Alexander, J.B., Kupwade-Patil, K., Calle, L.M., Field Testing of Rapid Electrokinetic Nanoparticle Treatment for Corrosion Control of Steel in Concrete, National Aeronautics and Space Administration, Technical Report, NASA/TM-2009-214761, August 2009.

Hock, V. F., Cardenas, H., Knoll, R., and Hall, V., "Demonstration of Anti-Scale/Corrosion Resistant Coatings for Hot Water Heat Exchangers", Report Number ERDC/CERL TR-01-6 (2001), U.S. Army Construction Engineering Research Laboratories, Champaign, Illinois, 2001.

Hock, V. F., Cardenas, H., Smothers, K., and Zelsdorf, E., "Control of Plumbosolvency in Building Plumbing", Technical Report, U.S. Army Construction Engineering Research Laboratories, Champaign, Illinois, August 1996.

Hock, V. F., Cardenas, H., and Anderson, J., “Chemical Treatment of Domestic Water to Inhibit Dissolution of Lead in Building Plumbing”, Public Works Technical Bulletin, U.S. Army Directorate of Engineering and Housing, Ft. Belvoir, VA, December 1994.

Hock, V. F., Cardenas, H., Van Blaricum, V., and Knoll, R., “Demonstration of Anti-Scale/Corrosion Resistant Coatings for Mechanical Equipment Systems”, Facilities Engineers Applications Program Technical Report, U.S. Army Construction Engineering Research Laboratories, Champaign, Illinois, March 1994.

Hock, V. F., Cardenas, H., and Myers, J., “Field Test Results of Corrosion Resistant Coatings for Carbon Steel Steam Condensate Return Lines”, Technical Report, U.S. Army Construction Engineering Research Laboratories, Champaign, Illinois, October 1993.

Hock, V. F., Cardenas, H., Knoll, R., and Hall, V., “Field Test Results of Anti-Scale/Corrosion Resistant Coating for Hot Water Heat Exchangers”, Technical Report, U.S. Army Construction Engineering Research Laboratories, Champaign, Illinois, June 1993.

## Research Grants

Total of \$8 million in funding awarded.

Performance Period	Title	PI & Co-PI's	Funding Agency	Amount
4-30-04 to 4-30-05	Investigation of Nanoparticle Technology for Corrosion Mitigation in Launch Facility Infrastructure Materials	Henry E. Cardenas	LaSpace DART Program and Kennedy Space Center NASA	63,307.00
4-8-04 to 11-29-04	Advanced Electrokinetic Nanoparticle Treatment Process for Concrete	Henry E. Cardenas and Tony Forest – Co-PI	HRS, LLC	24,942.00
6-1-04 to 6-30-05	Enhancement of Materials Durability Education	Henry E. Cardenas	Louisiana BoR	69,138.00
3-1-05 to 11-30-05	Field Study of Nanoparticle Technology for Corrosion Control of Reinforced Concrete	Henry E. Cardenas	Kennedy Space Center, NASA	21,049.00
4-1-05 to 9-1-05	E-Seal Phase I Consultation and Development	SHOT Inc. – PI, Cardenas – Co-PI	Office of the Secretary of Defense, Phase SBIR I	153,900.00
9-1-05 to 5-1-06	Tarnish Control of Electroplated Press Cylinders	Henry E. Cardenas	Southern Graphics Systems LLC	36,679.00
6-1-05 to 12-31-05	Reactive Electrophoretic Consolidation of Fine Construction Aggregates	Henry E. Cardenas	Osmotech LLC	46,689.00

9-1-05 to 12-31-10	Electrokinetic Strategies for Moisture Control and Durability of Ceramic Structures	Henry E. Cardenas	Osmotech LLC	4,424,000.00
8-1-06 to 9-28-07	E-Seal Phase II Treatment Optimization and Crack Repair	Henry E. Cardenas	Office of the Secretary of Defense, SBIR Phase II	1,500,000.00
8-1-06 to 6-30-09	Rapid Rehabilitation of Hurricane Damaged Structures	Henry E. Cardenas	Louisiana ITRS	316,219.00
5-1-07 to 6-30-08	Electrochemical Oil Spill Prevention	Cardenas - PI, David Hall – Co-PI	Oil Spill Prevention Research and Development Program	50,912.00
1-1-08 to 12-30-08	Electrokinetic Decontamination and Repair of Concrete	Cardenas, Kanno, Eklund	Entergy Nuclear Inc.	106,00.00
10-1-07 to 11-30-09	Electrokinetic Bone Tissue Repair	Cardenas, Sit, Eklund	Smith and Nephew Inc.	273,326.00
2-1-10 to 6-30-10	Review of Biodynamics in Airbags	Henry E. Cardenas	Impact Biodynamics	11,000.00
10-1-10 to 3-1-11	Electrokinetic Enhancement of Concrete	Henry E. Cardenas	A.J. Weller Corp.	3,454.00
4-1-10 to 11-1-10	Electrokinetic Treatment for Relief of Anesthetic Side Effects	Henry E. Cardenas	Escribano	25,000.00 Pending

## Patents

2006: U.S. Patent “Concrete Corrosion Control via Electrophoretic Nanoparticle Treatment, filed March 2006.

2006: U.S. Patent No. 60/647,509 (Pending) “Strength Enhancement of Concrete via Electrophoretic Nanoparticle Treatments”, filed January 2006.

2008: U.S. Patent “Electrokinetic Bone Tissue Repair”, file April 2008.

## Service - Professional

Reviewer:

ASTM Journal of Materials

American Society of Civil Engineers Journal of Materials in Civil Engineering.

Committee Member:

American Concrete Institute, Committee 364: Rehabilitation. Developing FAQ on when it is appropriate to use calcium chloride in concrete.

## Service - Academic Program

Mechanical Engineering Program Lab Team, 2006 - present  
ME Research Coordinator, 2005 - present

### **Service - College**

Director, Applied Electrokinetics Laboratory 2007 to present

### **Service - Community**

Christ Source Ministries, Men's Prayer Ministry Team Leader 2010 - present

Scout Master, Boy Scout Troop 45, Ruston, from 2005  
to present

Small Group Leader, Christ Community Church, Ruston, 2005 to 2007.

### **Invited Lectures/Presentations**

Cardenas, H., "Using Electricity and Nanotechnology for Concrete Rehabilitation",  
Louisiana Engineering Society, University Club, Shreveport, LA, 13 Jan. 2011.

Cardenas, H., "Electromutagenic Concrete Rehabilitation", Sustainable Infrastructure  
Systems Conference, Shreveport, 28 Oct. 2010.

Kanno, J., Maindardi, D., Cardenas, H., "Electromutagenic Materials Processing",  
Louisiana Industry-Academia Collaborative Workshop, Baton Rouge, 15 Oct. 2010.

Cardenas, H., Stefan, J., "Investigation of Reactive Nanoparticle Transport for Corrosion  
Mitigation in Reinforced Concrete", Faculty-Student Intern Team Presentation, NASA,  
Kennedy Space Center, FL, 12 August, 2010.

Cardenas, H., Alexander, J., Kupwade-Patil, K., Calle, Luz Marina, "Corrosion Control  
in Coastal Structures", ASCE Structures Conference, Orlando, FL, 9 May, 2010.

Cardenas, H., "Electrokinetic Enhancement of Material Surfaces", A. J. Weller  
Corporation, Shreveport, LA, 3 April, 2010.

Cardenas, H., "Electrokinetic Materials Processing", Celexion Inc., Bossier City, LA, 9  
March, 2010.

Cardenas, H., "Electrokinetic Bone Implant Enhancement", LSU Medical School  
Seminar, 9 March, 2010.

Cardenas H., Calle, L., Kunal Kupwade-Patil, Alexander, J., “Rebar Corrosion in Reinforced Concrete – Current Research and Investigations”, North American Steel Construction Conference, Orlando FL, 20 Jan. 2010.

Maindardi, D., Kanno, J., Kupwade-Patil, K., Cardenas, H., “Corrosion and Sulfate Attack Mitigation in Concrete using Electrokinetic Nanoparticle Treatment, Annual Meeting of the American Electrophoresis Society, Nashville, TN, 8 November, 2009.

Cardenas, H., “Using Nanotechnology to Modify Engineering Materials”, Pole Universitaire Leonard De Vinci, Paris France, 21 March, 2009.

Cardenas, H., “Electrokinetic Treatment in Concrete”, Collaboration visit with Corps of Engineers, Waterways Experiment Station, Vicksburg, MS, January, 2009.

Venkateshaiah, H., Kanno, J., Richarson, N., Philips, J., Kupwade-Patil, K., Cardenas, H., Mainardi, D., “Dynamics of Solvated Chloride Inhibition by Nanoparticle Treated Concrete”, AIChE, November, 2008.

Cardenas, H., Hall, D., Moral, O., “Electrochemical Oil Spill Prevention”, Texas and Louisiana Oil Spill Prevention Consortium”, San Antonio, TX, October, 2008.

Cardenas, H., Calle, L., Alexander, J., Kupwade-Patil, K., “Field Testing of Electrokinetic Nanoparticle Treatment to Mitigate Corrosion in Concrete”, National Association of Corrosion Engineers Eastern Region Conference, NACE International, Cocoa Beach FL, October, 2008.

Gordon, K., Lee, L., Cardenas, H., “Improving Reinforced Concrete Infrastructure Using Electrokinetic Treatments and FRP Rehabilitation”, 52<sup>nd</sup> International Society for the Advancement of material and Process Engineering (SAMPE) Symposium and Exhibition, Baltimore MD, June, 2007.

Cardenas, H., “Overview of Nanotechnology”, presented to Karaganda State University, Karaganda, Kazakhstan, 31 May, 2007.

Cardenas, H., “Nanotechnology of Concrete”, presented to Karaganda State University, Karaganda, Kazakhstan, 31 May, 2007.

Cardenas, H., “Review of Electrokinetic Concrete Repair Methodologies”, presented to Structural Preservation Systems, Inc, and the U.S. Army Corps of Engineers in Urbana Champaign, Illinois, 21 May 2007.

Cardenas, H., “Modeling of Electrokinetic Corrosion Repair Processes in Concrete”, presented to Osmotech, Inc., and Nalco Chemical Corporation, Naperville, Illinois, 22 May, 2007.

Cardenas, H., "Electrochemical Concrete Repair Strategies using Nanoscale Pozzolans", for American Concrete Institute Committee 364, Rehabilitation, 22 April, 2007.

Cardenas, H., "Electrokinetic Processes for Advanced Bridge Maintenance", Louisiana Transportation Research Center Bridge Maintenance Group, Baton Rouge, LA, 2 February, 2007.

Cardenas, H., "Nanoparticle Loading of Cement" for the Functional Nano-Assemblies Seminar at the Institute for Micromanufacturing, Louisiana Tech University, March 2006.

Cardenas, H., "Electrokinetic Nanoparticle Treatment for Repair and Upgrade of Concrete", Invited talk for Kennedy Space Center, FL., Delivered to Corrosion Control Group, January 2005.

Cardenas, H., "Zero-VOC, Electrokinetic Nanoparticle Coating and Repair of Concrete", Invited talk for Environmental Protection Agency, Research Triangle Park, NC, Delivered to Indoor Air-Quality Group, January 2005.

Cardenas, H., "Electrokinetic Nanoparticle Technology for Repair of Concrete Structures", Presented to Research Directorate, Head Quarters, U.S. Army Corps of Engineers, Washington D.C., 8 January 2004.

Cardenas, H., "Nanoparticles Agents of Change", Special briefing for NASA Chief Administrator Shawn O'Keefe, May 2004.

Cardenas, H., "Electrokinetic Nanoparticle Treatment Processes for Mitigation of Concrete Corrosion in Launch Facilities" Presented to Operations Branch, NASA, Kennedy Space Center, FL, 3 November 2003.

Cardenas, H., and Aldrich, G., "Construction and Materials Engineering Methods in Track and Field Facility Construction", Presented to U.S. Track Builders Association, Nashville, TN, 8 November 2001.