

Hamdy Ibrahim

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CURRENT POSITION

Assistant Professor in the Mechanical Engineering Department at The University of Tennessee at Chattanooga.

RESEARCH INTERESTS

My current research is in materials science and engineering with major focus on processing and characterizations of biomaterials for a wide range of applications including biomedical devices. Research areas include biodegradable composites, biodegradable metals (e.g. magnesium), shape memory alloys (e.g. nitinol), additive manufacturing, surface treatments, and corrosion behavior of biomaterials.

EDUCATION

Ph.D., Mechanical Engineering

University of Toledo

Toledo, Ohio

Dec. 2017

two patent, applications # PCT/US16/68038 & PCT/US15/919,513

Dissertation Title: "Bioresorbable Magnesium-Based Bone Fixation Hardware: Alloy Design, Post-Fabrication Heat Treatment, Coating, and Modeling"

Committee: Mohammad Elahinia (chair), Sarit Bhaduri, Matthew Franchetti, Arunan Nadarajah, Efstratios Nikolaidis

M.Sc., Mechanical Engineering

Cairo University

Cairo, Egypt

May 2012

Thesis Title: "Characteristics of Corn Starch-Based Composites Reinforced with Flax and Date Palm Fibers"

Committee: Mahmoud Farag (chair), Amal Esawi, Niveen Mawsouf, Hassan Megahed

B.Sc., Mechanical Engineering

Cairo University

Cairo, Egypt

May 2008

Top 10% of graduating class

Senior Project: "Design and Implementation of a City Hybrid Car"

INVENTION DISCLOSURES AND PATENTS

1. **Ibrahim, H.** and Elahinia, M. Heat Treatment Process to Produce High Strength and Corrosion Resistance Mg-Ca-Zn Alloy for Patient-Specific Bioresorbable Bone Fixation Hardware. *WO2017112779A1*, December 21, 2015.
2. Cooper J.C., Elahinia, M., Gupta, R. & **Ibrahim, H.** Minimally Invasive Thrombectomy Device. *CIP, US20150265299A1*, April 2, 2015.

PEER-REVIEWED PUBLICATIONS

1. Moghaddam, N. S., Saghaian, S. E., Amerinatanzi, A., **Ibrahim, H.**, Li, P., Toker, G. P., ... & Elahinia, M. (2018). Anisotropic tensile and actuation properties of NiTi fabricated with selective laser melting. *Materials Science and Engineering: A*.
2. **Ibrahim, H.**, Jahadakbar, A., Dehghan, A., Moghaddam, N. S., Amerinatanzi, A., & Elahinia, M. (2018). In Vitro Corrosion Assessment of Additively Manufactured Porous NiTi Structures for Bone Fixation Applications. *Metals*, 8(3), 164.
3. **Ibrahim, H.**, Klarner, A. D., Poorganji, B., Dean, D., Luo, A. A., & Elahinia, M. (2017). Microstructural, Mechanical and Corrosion Characteristics of Heat-Treated Mg-1.2 Zn-0.5 Ca (wt.%) Alloy for Use as Resorbable Bone Fixation Material. *Journal of the Mechanical Behavior of Biomedical Materials*, 69, 203-212.
4. **Ibrahim, H.**, Esfahani, S., Poorganji, B., Dean, D., & Elahinia, M. (2017). Resorbable Bone Fixation Alloys, Forming, and Post-Fabrication Treatments. *Materials Science and Engineering C*, 70, 870-888.
5. **Ibrahim, H.**, Mehanny, S., Darwish, L., & Farag, M. (2017). A Comparative Study on The Mechanical, Biodegradation and Morphological Behavior of Starch-Based Composites Reinforced with Lignocellulosic Fibers. *Journal of Polymers and the Environment*.
6. Ma, C., Taheri, M., Qin, H., Shayesteh Moghaddam, N., **Ibrahim, H.**, Jahadakbar, A., Amerinatanzi, A., Ren, Z., Zhang, H., Doll, G., Dong, Y., Elahinia, M., & Ye, C (2017). Improving Surface Finish and Wear Resistance of Additive Manufactured Nickel-Titanium by Ultrasonic Nano-Crystal Surface Modification, *Journal of Materials Processing Technology*, 249, 433-440.
7. **Ibrahim, H.**, Shayesteh Moghaddam, N., Elahinia, M. (2017). Mechanical and In Vitro Corrosion Properties of a Heat-Treated Mg-Zn-Ca-Mn Alloy as a Potential Bioresorbable Material, *Advances in Metallurgical and Material Engineering*, 1(1):1-7.
8. **Ibrahim, H.**, Farag, M., Megahed, H., & Mehanny, S. (2014). Characteristics of Starch-Based Biodegradable Composites Reinforced with Date Palm and Flax Fibers. *Carbohydrate polymers*, 101, 11-19.
9. Mehanny, S., Farag, M., & **Ibrahim, H.** (2014). The Influence of Fiber Content on Properties of Thermoplastic Eco-Friendly Composite. *Transaction on Control and Mechanical Systems*, 3 (1).
10. Mehanny, S., **Ibrahim, H.** Darwish, L., & Farag, M. Effect of Animal Glue at Different Processing Temperatures on the Mechanical Properties of Starch-Based Biodegradable Composites Reinforced with Bagasse Fibers. *Journal of Natural Fibers*, under review.
11. **Ibrahim, H.** and Elahinia, M. Heat Treatment and Micro Arc Oxidation Coating Processes on Mg-0.5%Ca-x%Zn Alloys for Controlled Corrosion Behavior. *Materials Characterization*, under review.
12. **Ibrahim, H.**, Amir Dehghan, David Dean, and Elahinia, M. Development of a TiO₂ and HA/ β -TCP composite coating on a Mg-Zn-Ca alloy using MAO and sol-gel coating processes. *Alloys and Design*, under review.

13. Moghaddam N.S., Saghaian S.E., Amerinatanzi A., **Ibrahim H.**, Karaca H., & Elahinia M. Additively manufactured superelastic NiTi: a paradigm shift to eliminate heat treatment. *Scripta Materialia*. under review.

BOOK CHAPTERS

1. Mehanny, S., Darwish, L., **Ibrahim, H.**, El-Wakad, M. T., & Farag, M. (2016). High-Content Lignocellulosic Fibers Reinforcing Starch-Based Biodegradable Composites: Properties and Applications. In *Composites from Renewable and Sustainable Materials*, InTech, ISBN: 978-953-51-2793-2.

CONFERENCE PAPERS

1. Dehghanghadikolaie, A. **Ibrahim, H.**, Amerinatanzi, A., Shayesteh, N.M., Ellahinia M. (2018, July). Corrosion Behavior of Micro-Arc Oxidation Coated Additively Manufactured NiTi: An Experimental Study. In the *18th International Conference on the Strength of Materials (ICSMA 18)*. Columbus, Ohio.
2. Dean, D., **Ibrahim, H.**, Klarner, A., Meier, J., Luo, A., Advincula, R., Bertone, A., Valerio, I., Larsen, P., Emam, H., Skoracki, R., Miller, M., Elahinia, M. (2018, July). Corrosion of Heat- and MAO-Treated Mg-1.2Zn-0.5Ca-0.5Mn: A Candidate Alloy for Bioresorbable Skeletal Fixation. In the *18th International Conference on the Strength of Materials (ICSMA 18)*. Columbus, Ohio.
3. **Ibrahim, H.**, Jahadakbar, A., Shayesteh Moghaddam, N., Amerinatanzi, A., and Elahinia, M. (2017, October). In Vitro Corrosion Behavior of Additively Manufactured Niti Porous Structures for Bone Implant Applications. *Materials Science & Technology*. Pittsburg, PA.
4. **Ibrahim, H.**, Klarner, A., Dean, D., Luo, A., and Elahinia, M. (2017, October). Heat Treatment and Coating of Mg-1.2Zn-0.5Ca for the Fabrication of Bioresorbable Bone Fixation. In *International Conference on Biofabrication*. Beijing, China.
5. **Ibrahim, H.**, Klarner, A., Luo, A., Dean, D., Elahinia, M. (2017, August). Processing of a Magnesium-Based Alloy Towards Bioresorbable Bone Fixation Hardware. In *Military Health System Research Symposium (MHSRS)*, Kissimmee, FL.
6. Dean, D., **Ibrahim, H.**, Klarner, A., Luo, A., Valerio, I., Skoracki, R., Miller, M., Elahinia, M. (2017, August). Corrosion of Heat-Treated and MAO Coated Mg-1.2Zn-0.5Ca-0.5Mn: A Candidate Alloy for Bioresorbable Skeletal Fixation. In *9th Symposium on Biodegradable Metals for Biomedical Applications*, Bertinoro, Italy.
7. Elahinia, M., **Ibrahim, H.**, Dean, D., Klarner, A., Luo, A., Valerio, I., Skoracki, R., Miller, M. (2017, August). Choice of Mg-1.2Zn-0.5Ca-0.5Mn Alloy and Heat Treatment Strategy: A Candidate Alloy for Bioresorbable Skeletal Fixation. In *9th Symposium on Biodegradable Metals for Biomedical Applications*, Bertinoro, Italy.
8. Amerinatanzi, A., Moghaddam, N., Saedi, S., **Ibrahim, H.**, Karaca, H., and Elahinia, M. (2017, August). On the Effect of Building Direction on the Microstructure and Tensile Properties of SLM NiTi. In *28th Solid Freeform Fabrication Symposium*. Austin, Texas.
9. McManus, T., MacDonald, T., Wandel, M., **Ibrahim, H.**, Klarner, A., Luo, A., Elahinia, M., and Dean D. (2017, August). Cytotoxicity of a Novel Magnesium Alloy for Resorbable Bone Fixation Devices. *OSU Fall Undergraduate Research Forum*. Columbus, Ohio.

10. **Ibrahim, H.**, and Elahinia, M. (2017, June). Fabrication and Characterization of a Biocompatible Coating Formed on a Heat-Treated Magnesium Alloy Using Micro-Arc Oxidation. In *ASME 2017 12th International Manufacturing Science and Engineering Conference* (pp. V002T03A029-V002T03A029). American Society of Mechanical Engineers. Los Angeles, California.
11. **Ibrahim, H.**, Klarner, A., Poorganji, B., Dean, D., Luo, A., and Elahinia, M. (2017, March). Preparation and Characterization of a Heat-Treated and Coated Magnesium-Based Alloy for Bioresorbable Bone Fixation Applications. In *10th Annual Translational to Clinical (T2C) Regenerative Medicine Wound Care Conference*. Columbus, Ohio.
12. Jahadakbar, A., Amerinatanzi, A., Shayesteh Moghaddam, N., **Ibrahim, H.**, Mehrabi, R., and Elahinia, M. (2016, November). MorphBand: Patient-Specific, Stiffness-Matched Mandibular Fixation Plates. In *1st International Symposium on Academic Makerspaces at MIT*. Cambridge, MA.
13. Shayesteh Moghaddam, N., Amerinatanzi, A., Jahadakbar, A., Taheri Andani, **M., Ibrahim, H.**, Mehrabi, R., Karaca, H., and Elahinia, M. (2016, November). Additive Manufacturing of Nitinol Shape Memory Alloys. In *1st International Symposium on Academic Makerspaces at MIT*. Cambridge, MA.
14. Amerinatanzi, A., Zamanian, H., Moghaddam, N. S., **Ibrahim, H.**, Hefzy, M. S., & Elahinia, M. (2016, September). On the Advantages of Superelastic Niti in Ankle Foot Orthoses. In *ASME 2016 Conference on Smart Materials, Adaptive Structures and Intelligent Systems* (pp. V002T03A026-V002T03A026). American Society of Mechanical Engineers. Stowe, Vermont.
15. Amerinatanzi, A., Moghaddam, N. S., **Ibrahim, H.**, & Elahinia, M. (2016, September). The Effect of Porosity Type on the Mechanical Performance of Porous NiTi Bone Implants. In *ASME 2016 Conference on Smart Materials, Adaptive Structures and Intelligent Systems* (pp. V002T06A018-V002T06A018). American Society of Mechanical Engineers. Stowe, Vermont.
16. Amerinatanzi, A., Moghaddam, N. S., **Ibrahim, H.**, & Elahinia, M. (2016, September). Evaluating a Niti Implant Under Realistic Loads: A Simulation Study. In *ASME 2016 Conference on Smart Materials, Adaptive Structures and Intelligent Systems* (pp. V002T03A030-V002T03A030). American Society of Mechanical Engineers. Stowe, Vermont.
17. **Ibrahim, H.**, Klarner, A. D., Poorganji, B., Dean, D., Luo, A. A., & Elahinia, M. (2016, June). The Effect of Heat-Treatment on Mechanical, Microstructural, and Corrosion Characteristics of a Magnesium Alloy with Potential Application in Resorbable Bone Fixation Hardware. In *ASME 2016 11th International Manufacturing Science and Engineering Conference* (pp. V002T01A012-V002T01A012). American Society of Mechanical Engineers. Blacksburg, Virginia.
18. **Ibrahim, H.**, Gupta, R., Cooper, C., & Elahinia, M. (2015, February). Design and Experimental Evaluation of a Superelastic Nitinol-Based Percutaneous Mechanical Thrombectomy Device. In *Midwest American Society Biomechanics Regional Meeting*, Akron, Ohio.
19. Mehanny, S., Farag, M., Rashad, R. M., & **Elsayed, H.** (2012, November). Fabrication and Characterization of Starch Based Bagasse Fiber Composite. In *ASME 2012 International Mechanical Engineering Congress and Exposition* (pp. 1345-1353). American Society of Mechanical Engineers. Houston, Texas.
20. **Elsayed, H.**, Farag, M., Megahed, H., & Mehanny, S. (2012, November). Influence of Flax Fibers on Properties of Starch-Based Composites. In *ASME 2012 International Mechanical Engineering*

Congress and Exposition (pp. 1397-1408). American Society of Mechanical Engineers. Houston, Texas

GRANTS & PROPOSAL ASSISTANCE

1. **Ibrahim, H.**, Elahinia, M., & Eltahawy, E. “Degradation and strength-tuned magnesium-based coronary stents”, AHA collaborative sciences award, submitted to the American Heart Association (AHA), 2017. Status: Pending.
2. Elahinia, M. “Addressing Pulmonary Embolism with QuickFlow PE”, NSF-National I-Corps program proposal, submitted to the National Science Foundation (NSF), 2016. Status: Accepted.

CONFERENCES AND WORKSHOPS ATTENDED

1. American Society of Mechanical Engineers (ASME) 12th International Manufacturing Science and Engineering Conference (MSEC), Los Angeles, California, **June 2017**, *Oral Presentation*.
2. NSF SBIR Phase I Workshop and Beat the Odds Boot Camp, Washington D.C., **March 13-15, 2017**.
3. 10th Annual Translational to Clinical (T2C) Regenerative Medicine Wound Care Conference, Columbus, Ohio, **March 2017**, *Poster Presentation*.
4. The UC Annual Sensor Community Retreat, University of Cincinnati, Ohio, **Jan. 2017**, *Elevator Pitch Competition*.
5. American Society of Mechanical Engineers (ASME) Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS), Stowe Vermont, **Nov. 2016**, *Oral Presentation*.
6. American Society of Mechanical Engineers (ASME) 11th International Manufacturing Science and Engineering Conference (MSEC), Blacksburg, Virginia, **June 2016**, *Oral Presentation*.
7. NSF National I-Corps Workshops, Houston, Texas, **Feb. 2016 & March 2016**.
8. Midwest American Society Biomechanics Regional Meeting, Akron, Ohio, **Feb. 2015**, *Oral Presentation*.
9. American Society of Mechanical Engineers (ASME) International Mechanical Engineering Congress and Exposition (IMECE), Houston, Texas, **Nov. 2012**, *Oral Presentation*.

RESEARCH EXPERIENCE

Chief Research Officer

Thermomorph, LLC

Toledo, Ohio

Feb 2018-July 2018

- Conducted research aimed at developing biomedical devices particularly the clot removal device “QuickFlow PE”.
- Assisted in developing an industry-focused, commercialization feasibility assessment aimed at recommending/delineating milestones and evaluating potential license value to the developed devices.

Postdoctoral Fellow

DSS-Lab at the University of Toledo

Toledo, Ohio

Aug 2017-July 2018

- Designed and led a research project aiming to develop a biocompatible coating for metallic porous bone implants. Resulted in 2 publications submitted to specialized surface treatment journals.
- Monitored and advised a masters student (Amir Dehghan) during his thesis project. Amir Dehghan is currently a PhD student at Oregon State University.

Ph.D. Research Assistant

University of Toledo

Toledo, Ohio
Sep 2013-Dec 2017

- Conducted doctoral dissertation research with Dr. Mohammad Elahinia.
- Successfully designed and started a research project to develop a safe and biodegradable metallic-based bone fixation hardware. Resulted in 3 publications and 2 submissions to various Materials Science and Engineering journals.
- Invented a novel post-shaping process for the biomedical use of a magnesium-based alloy, patent application # PCT/US16/68038 (<http://utoledo.technologypublisher.com/technology/21394>).
- Participated in the development and commercialization of QuickFlow-PE, a clot removal device.
- Collaborated in the fabrication and testing of additively-manufactured (3D-printed) patient-specific bone implants made of shape memory alloys (nitinol-based).

M.Sc. Research Assistant

Cairo University and American University in Cairo (AUC)

Cairo, Egypt
Oct 2010-Sep 2013

- Conducted master’s thesis research with Dr. Mahmoud Farag.
- Initiated a research project to develop strong, affordable and completely biodegradable materials made of environmental-friendly “green” composites. Resulted in 4 publications/conference papers and one book chapter.
- Collaborated in the preparation of biodegradable materials and the testing process of their mechanical, microstructural and biological properties.

SERVICES

Materials Science & Technology Conference (MS&T 18), Columbus, OH 2018

- **Co-organizer** for a symposium on “Advanced Manufacturing, Processing, Characterization, and Modeling of Functional Materials”.

MDPI – Bioengineering Journal 2018

- **Guest editor** for a special issue on "Engineering Bone-Implant Materials".

PEER-REVIEWING JOURNALS

Corrosion Science (Elsevier) 2018

Bioelectrochemistry (Elsevier) 2017

Journal of Polymers and the Environment (Springer) 2017

Journal of Natural Fibers (Taylor & Francis) 2017

Journal of Alloys and Compounds (Elsevier) 2016

Sensors & Actuators: A. Physical (Elsevier) 2016

Journal of Intelligent Material Systems and Structures (SAGE) 2016

Journal of Vibration and Control (SAGE) 2016

Kovove materialy-metallic materials
African Journal of Agricultural Research

2016
2014

TEACHING AND LEADERSHIP EXPERIENCE

University of Toledo

Toledo, OH

Teaching Instructor and Assistant

Sep 2013-July 2018

- Instructed two engineering courses (Engineering Statics - CIVE1150 and Mechanics Lab - MIME3330) for a total of more than 160 students.
- Prepared materials for an Additive Manufacturing course and assisted in teaching undergraduate courses such as Materials Science Lab and Engineering Economics.
- Supervised undergraduate students in senior year research projects.
- Mentored and advised graduate and undergraduate students through their M.Sc. and co-ops projects in the dynamics and smart systems lab (DSSL) at the UT.

NSF SBIR Phase I Workshop and Beat-the-Odds Boot Camp

Washington D.C.

Entrepreneurial Lead

Feb 2017-March 2017

- Collaborated in the process of market validation and commercialization plan preparation of a new clot removal device “QuickFlow-PE”.
- Participated in the preparation for the NSF SBIR phase II proposal.
- Interviewed 30 physicians and personnel in the medical field in the US to build a strong business model for the innovative technology.

NSF National I-Corps Program

Houston, Texas

Entrepreneurial Lead

Feb 2016-March 2016

- Led an I-Corps team with deep commitment to investigate the commercial landscape surrounding the innovation of the new clot removal device, “QuickFlow-PE”.
- Interviewed more than 90 physicians and personnel in the medical field in the US to identify the innovation’s value proposition and potential customer segments.

Cairo University

Cairo, Egypt

Teaching Fellow

Jan 2010-Sep 2013

- Tutored and assisted engineers for the Fundamentals of Engineering (FE) examination.
- Assisted in teaching 7 undergraduate courses. Topics included Properties and Testing of Materials, Materials Science, Metal Joining Engineering, Manufacturing Engineering, and Production Engineering.
- Lectured classes of 30-40 undergraduate students, supervised labs, and evaluated performances.
- Participated in the reorganizing of the Metallography lab. Tasks included assessing the performance of the existent instruments, determining the instruments to be maintained, and proposing new instruments to be purchased.

TEACHING INTERESTS

Engineering Mechanics: Statics, Materials Science and Engineering, Manufacturing Engineering, Mechanics of Materials, Dynamics and Vibration, Properties and Testing of Materials.

SELECTED AWARDS AND RECOGNITIONS

- First place for the \$10,000 Business Plan Competition – School of Business at the UT 2018
- Excellent Performance in the UC Sensor Retreat - Elevator Pitch Competition 2017
- NSF Student Travel Award for MSEC2016/NAMRC44 Conference 2016 and 2017
- Finalist in 2016 SMASIS Best Student Hardware Paper Competition 2016
- Yousef Jameel Science & Technology Research Center fellowship (YJ-STRC) 2010
- Cairo University Graduate Studies Scholarship 2009
- Cairo University Undergraduate Studies Scholarship 2004

SKILLS

Computer: Matlab, AutoCAD, SolidWorks, Minitab, Abaqus and Primavera.

Lab: Additive manufacturing, SEM, XRD, mechanical testing and corrosion testing.

Teaching skills:

Interpersonal Skills: Strong communication skills and teamwork spirit.

Time Management: I succeeded to complete my M.Sc. within 2 years, and my Ph.D. within 4 years without fail in meeting the many deadlines in my teaching and research duties.

PROFESSIONAL AFFILIATION

- | | |
|---|--------------|
| American Society of Mechanical Engineers (ASME) | 2016-present |
| Society of Manufacturing Engineers (SME) | 2017-present |