

HOLDEN HYER

CURRICULUM VITAE

PERSONAL INFORMATION

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EDUCATION

2017-2020 University of Central Florida (UCF),
Orlando, FL
PhD, Materials Science and Engineering Dissertation title was "Understanding solidification of select aluminum and magnesium alloys additively manufactured by laser powder bed fusion"
Advisor: Prof. YONGHO SOHN. yongho.sohn@ucf.edu

2013-2017 New Mexico Institute of Mining and
Technology (NMT), Socorro, NM
BS, Majored in Materials Engineering An emphasis in metallurgy. Graduated with highest honors. Advisor:
Prof. BHASKAR MAJUMDAR. bhaskar.majumdar@nmt.edu

RESEARCH / WORK EXPERIENCE

Feb. 2021- Current R&D Associate, OAK RIDGE
ORNL NATIONAL LABORATORY (ORNL), OAK RIDGE, TN
Part of the Nuclear Energy and Fuel Cycle Division, Nuclear Fuel Development Section, Advanced Fuel Fabrication and Instrumentation Group at ORNL.
Work includes exploring the embedment of temperature and strain sensors in additively manufactured metals as well as investigations in additive manufacturing of refractory metals such as Mo and W based alloys.
Reference: CHRISTIAN PETRIE petriecm@ornl.gov

Aug. 2017- Dec. 2020 Graduate Research Assistant, UNIVERSITY OF
UCF CENTRAL FLORIDA (UCF), ORLANDO, FL
Exploring gas atomization of metallic materials and using our own atomized powders in additive manufacturing processes, such as laser powder bed fusion. Work includes laser powder bed fusion of Fe alloys SS316L, SS304L, SS15-5PH, FeCoCrNi, and bulk-metallic-glasses, Ni-based superalloys IN718, IN625, and CM247, Al-alloys AlSi10Mg, AA5083, AA6061, AA7075, others, Cu-alloys Cu-10Sn and pure-Cu, Ti-alloy Ti-6Al-4V, and Mg-alloy WE43.
Reference: YONGHO SOHN yongho.sohn@ucf.edu

2016-2019 Student Researcher, LOS ALAMOS NATIONAL
LANL LABORATORY (LANL), LOS ALAMOS, NM
Explored induction melting of metallic alloys and thermal gradients of high-temperature casting crucibles. Part of research team investigating corrosion mechanisms to failure of radiological containers.

2015-2017 Researcher, Various, MATERIALS ENGINEERING
NMT DEPARTMENT, NMT, SOCORRO, NM
Student researcher, learning coach, and teaching assistant.
Reference: PROF. BHASKAR MAJUMDAR bhaskar.majumdar@nmt.edu

PRESENTATION SESSIONS

	<i>February 2020</i>	Metals, Minerals, & Materials Society (TMS)
TMS	Annual professional materials conference. Performed a 20-minute oral presentation on effect of post-heat treatment on microstructure of additively manufactured IN625. Also, presented a poster on the effects of solidification of additively manufactured varied Si content in Al-Si binary alloys.	
	<i>October 2019</i>	Materials Science & Technology (MS&T)
MS&T	Annual professional materials conference. Performed a 20-minute oral presentation on the additive manufacturing of dense WE43.	
	<i>March 2019</i>	Metals, Minerals, & Materials Society (TMS)
TMS	Annual professional materials conference. Performed a 20-minute oral presentation on single laser track scans of AA5083 and modified AA5083+Zr bulk alloys towards additive manufacturing.	
	<i>October 2018</i>	Materials Science & Technology (MS&T)
MS&T	Annual professional materials conference. Performed a 20-minute oral presentation on a processing parametric investigation of AlSi10Mg by additive manufacturing.	
	<i>May 2017</i>	Student Research Symposium (SRS), NMT
NMT-SRS	Group poster presentation on senior design project. Project details included selecting proper materials for enhancing thermal conductivity of heat transfer fluids.	
	<i>March 2017</i>	Material Advantage (ASM) Poster Competition, NMT
ASM	Poster competition hosted by Material Advantage. Posters presented by students in materials department at NMT. Was awarded best poster. Project details included studying tensile mechanical behavior of thermomechanically processed nano-crystalline Al alloys.	
	<i>March 2017</i>	Metals, Minerals and Materials Society (TMS) Conference, San Diego, CA
TMS	Annual professional materials conference. Presented 20-minute oral presentation on thermomechanical processing of nano-crystalline Al-Mg alloys.	
	<i>October 2016</i>	Rio Grande Symposium for Advanced Materials (RGSAM), Albuquerque, NM
RGSAM	Poster presentation at the annual RGSAM conference, hosted by the ASM Albuquerque Chapter. Project details included thermomechanical processing of nano-crystalline Al-Mg alloys.	

PUBLICATIONS

[31] **Hyer, H. C.**, Petrie, C. M. Effect of powder layer thickness on the microstructural development of additively manufactured SS316. (2022). *Journal of Manufacturing Processes*. 76:666-674.

[30] **Hyer, H. C.**, Sweeney, D. C., Petrie, C. M. Functional fiber-optic sensors embedded in stainless steel components using ultrasonic additive manufacturing for distributed temperature and strain measurements. (2022). *Additive Manufacturing*. 52:102681.

[29] **Hyer, H.**, Carver, K., List, F., Petrie, C. Embedding Sensors in 3D Printed Metal Structures. (2021). Oak Ridge National Lab. (ORNL), Oak Ridge, TN (United States): Medium: ED.

[28] **Hyer, H.**, Sweeney, D., Petrie, C. Characterization of Embedded Sensors in Stainless Steel Test Articles and Design/Planning for MAGNET Testing. (2021).

Oak Ridge National Lab. (ORNL), Oak Ridge, TN (United States): Medium: ED.

[27] Petrie, C.M., Schrell, A., **Hyer, H.**, Richardson, D., Vasudevamurthy, G. Performance of Embedded Sensors in 3D Printed SiC. (2021). Oak Ridge National Lab. (ORNL), Oak Ridge, TN (United States): Medium: ED.

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[26] Huynh, T., Mehta, A., Graydon, K., Woo, J., Park, S., **Hyer, H.**, Zhou, L., Imholte, D.D., Woolstenhulme, N.E., Wachs, D.M. Sohn, Y. Microstructural Development in Inconel 718 Nickel-Based Superalloy Additively Manufactured by Laser Powder Bed Fusion. (2022). *Metallography, Microstructure, and Analysis*. 11:88-107.

[25] Mehta, A., Zhou, L., **Hyer, H.**, Huynh, T., Lu, B., Graydon, K., Drobner, E.J., Park, S.H. Sohn, Y. Microstructural characteristics and mechanical properties of additively manufactured Cu-10Sn alloys by laser powder bed fusion. (2022). *Materials Science and Engineering: A*. 838:142775.

[24] **Hyer, H.**, Mehta, A., Graydon, K., Kljestan, N., Knezevic, M., Weiss, D., D., McWilliams, B., Cho, K Sohn, Y High strength aluminum-cerium alloy processed by laser powder bed fusion. (2022). *Additive Manufacturing*, 52:102657.

[23] Mahmud, A., Huynh, T., Zhou, L., **Hyer, H.**, Mehta, A., Imholte, D. D., D.D., Woolstenhulme, N.E., Wachs, D.M, Sohn, Y. Mechanical behavior assessment of Ti-6Al-4V ELI alloy produced by laser powder bed fusion. (2021). *Metals*. 11:1671.

[22] Diaz Vallejo, N., Lucas, C., Ayers, N., Graydon, K., **Hyer, H.**, Sohn, Y. Process Optimization and Microstructure Analysis to Understand Laser Powder Bed Fusion of 316L Stainless Steel. (2021). *Metals*. 11(5): 832.

UCF

[21] Thapliyal, S., Shukla, S., Zhou, L., **Hyer, H.**, Agrawal, P., Komarassay, M., Sohn, Y., Mishra, R. Design of Heterogeneous Structured Al Alloys with Wide Processing Window for Laser-Powder Bed Fusion Additive Manufacturing. (2021). *Additive Manufacturing*. 42:102002.

[20] **Hyer, H.**, Zhou, L., Park, S., Huynh, T., Mehta, A., Thapliyal, Mishra, R., Sohn, Y. Elimination of Extraordinarily High Cracking Susceptibility of Aluminum Alloy Fabricated by Laser Powder Bed Fusion. (2021). *Journal of Materials Science and Technology*. 103:50-58.

[19] Mehta, A., Zhou, L., Huynh, T., Park, S., **Hyer, H.**, Song, S., Bai, Y., Imholte, D., Woolstenhulme, N., Wachs, D., Sohn, Y. Additive Manufacturing and Mechanical Properties of the Dense and Crack Free Zr-Modified Aluminum Alloy 6061 Fabricated by the Laser Powder Bed Fusion. (2021). *Additive Manufacturing*. 41:101966.

[18] **Hyer, H.**, Zhou, L., Liu, Q., Wu, D., Song, S., Bai, Y., McWilliams, B., Cho, K., Sohn, Y. High Strength WE43 Microlattice Structures Manufactured by Laser Powder Bed Fusion. (2021). *Materialia*. 16:101067.

[17] Park, T.H., Baek, M.S., **Hyer, H.**, Sohn, Y.H., Lee, K.A. Effect of Direct Aging on the Microstructure and Tensile Properties of AlSi10Mg Alloy Manufactured by Selective Laser Melting Process, *Materials Characterization*. 176:111113.

[16] **Hyer, H.**, Zhou, L., Mehta, A., Park, S., Huynh, T., Song, S., Bai, Y., Cho, K., McWilliams, B., Sohn, Y. (2020). Composition-Dependent Solidification Solidification Cracking of Aluminum-Silicon Alloys During Laser Powder Bed Fusion. (2021) *Acta Materialia*. 208:116698.

[15] **Hyer, H.**, Newell, R., Matejczyk, D., Hsie, S., Anthony, M., Zhou, L., Kammerer, C., Sohn, Y. (2020). Microstructural development in as-built and

heat treated IN625 component additively manufactured by laser powder bed fusion. (2020) *Journal of Phase Equilibria and Diffusion*.

[14] **Hyer, H.**, Zhou, L. Mehta, A., Sohn, Y. Effects of Alloy Composition and Solid-State Diffusion Kinetics on Powder Bed Fusion Cracking Susceptibility. (2020) *Journal of Phase Equilibria and Diffusion*.

[13] **Hyer, H.**, Zhou, L., Park, S., Gottsfritz, G., Benson, G., Tolentino, B., McWilliams, B., Cho, K., Sohn, Y. Understanding the Laser Powder Bed Fusion of AlSi10Mg Alloy. (2020) *Metallography, Microstructure, and Analysis*. 9:484–502.

[12] Zhou, L., Huynh, T., Park, S., **Hyer, H.**, Mehta, A., Song, S., Bai, Y., McWilliams, B., Cho, K., Sohn, Y. Laser powder bed fusion of Al - 10 wt.%Ce alloys: microstructure and tensile property. (2020) *Journal of Materials Science*. 55:14611–14625.

[11] Zhou, L., **Hyer, H.**, Thapliyal, S., Mishra, R. S., McWilliams, B., Cho, K., & Sohn, Y. Process-Dependent Composition, Microstructure, and Printability of Al-Zn-Mg and Al-Zn-Mg-Sc-Zr Alloys Manufactured by Laser Powder Bed Fusion. *Metallurgical and Materials Transactions A*, 1-13.

[10] Kuliiev, R., Orlovskaya, N., **Hyer, H.**, Sohn, Y., Lugovy, M., Ha, D., ... & Conti, L. (2020). Spark Plasma Sintered B₄C—Structural, Thermal, Electrical and Mechanical Properties. *Materials*, 13(7), 1612.

[9] **Hyer, H.**, Zhou, L., Benson, G., McWilliams, B., Cho, K., & Sohn, Y. (2020). Additive Manufacturing of Dense WE43 Mg Alloy by Laser Powder Bed Fusion. *Additive Manufacturing*, 101123.

[8] Thapliyal, S., Komarasamy, M., Shukla, S., Zhou, L., **Hyer, H.**, Park, S., & Mishra, R. S. (2020). An integrated computational materials engineering-anchored closed-loop method for design of aluminum alloys for additive manufacturing. *Materialia*, 9, 100574.

[7] Zhou, L., **Hyer, H.**, Park, S., Pan, H., Bai, Y., Rice, K. P., & Sohn, Y. (2019). Microstructure and mechanical properties of Zr-modified aluminum alloy 5083 manufactured by laser powder bed fusion. *Additive Manufacturing*, 28, 485-496.

[6] Zhou, L., **Hyer, H.**, Park, S., Sohn, Y., Rice, K. P., & Chen, Y. (2019). Investigation of Microstructure and Dispersoids/Precipitates in Additively Manufactured Aluminum Alloys. *Microscopy and Microanalysis*, 25(S2), 328-329.

[5] Yu, T., **Hyer, H.**, Sohn, Y., Bai, Y., & Wu, D. (2019). Structure-property relationship in high strength and lightweight AlSi10Mg microlattices fabricated by selective laser melting. *Materials & Design*, 182, 108062.

[4] Zhou, L., Pan, H., **Hyer, H.**, Park, S., Bai, Y., McWilliams, B., & Sohn, Y. (2019). Microstructure and tensile property of a novel AlZnMgScZr alloy additively manufactured by gas atomization and laser powder bed fusion. *Scripta Materialia*, 158, 24-28.

LANL

[3] Reeves, K. P., Karns, T., Stone, T. A., Narlesky, J. E., **Hyer, H.C.**, Smith, P. H., & Gaunt, A. J. (2018). Evaluating Corrosion Effects on the Stainless Steel Components of the SAVY-4000/Hagan Nuclear Material Storage Containers (No. LA-UR-18-25709). Los Alamos National Lab.(LANL), Los Alamos, NM (United States).

[2] Stroud, M. A., Hill, M. A., Tokash, J. C., Forsyth, R. T., & **Hyer, H.C.** (2017). Residual Stresses in SAVY 4000 and Hagan Container Bodies (No. LA-UR-17-28658). Los Alamos National Lab.(LANL), Los Alamos, NM (United States).

[1] **Hyer, H.C.**, Duque, J., Smith, P. H., & Stroud, M. A. (2017). Effects of Laser Etching on the Corrosion Susceptibility of SAVY 4000 and Hagan Containers

(No. LA-UR-17-28647). Los Alamos National Lab.(LANL), Los Alamos, NM (United States).

MEMBERSHIPS

2021-Current American Nuclear Society
 2015-Current Metals, Minerals, and Materials Society (TMS)
 2015-Current ASM International

COMPUTER SKILLS

Programming Python, Maple, Labview, Daisylab (Labview alternative)
Word Processing Microsoft Office, Origin & Kaleidagraph (graphing tool), Minitab (design of experiments), L^AT_EX
*Crystallography/
 Materials* Jade, Highscore, PowderCell, ThermoCalc
CAD/3D Printing SolidWorks, Creo Parametric, Magics, NetFabb, QuantAM
*Microscopy/Image
 Analysis* ImageJ, Digital Micrograph, TIA Microscopy, OIM
Fiber-Optic Luna OBR, Luna ODiSI, Luna 3D Viz

MACHINERY AND EQUIPMENT EXPERIENCE

Welding Neared certification in flat, uphill, and overhead welding utilizing **Miller and Lincoln Arc Welders**.

Alloy Production Batched and produced various alloys with **RF Induction Furnaces, Arc Furnaces** for utilization of new alloys in materials testing. Also used various **Muffle and Tube Furnaces** for homogenization and heat treatment of metals.

Cold Spray Worked on the technical side of a cold spraying facility that utilized a **XRC Motoman Arc-Welding Robot**. Worked with spraying various alloys such as pure Fe, pure Mo, Ti-6Al-4V, and SS316L& SS304L.

*Mechanical
 Testing* Employed both **MTS and Instron Tensile-Compressive Testing Machines** to test and analyze various samples ranging from Al- and Mg-alloys to Cu- and Fe-based alloys.

*Additive
 Manufacturing* Have spent over 300 hours with a **SLM Solutions 125 HL Laser Powder Bed Fusion System** and **Renishaw AM250-400 Laser Powder Bed Fusion System**. Expertise includes processing a wide range of alloys including Ti-, Al-, Mg-, Cu-, Fe-, Ni-, Mo-, and W-based alloys. Also worked with a **Fabrisonic Ultrasonic Additive Manufacturing System**, welding and build parts from Al-, Cu-, and Fe-based alloys.

Powder Production Along with an understanding of laser powder bed fusion, expertise includes working with a **Dong-Yang Induction Furnace Gas Atomization Unit** to produce powders of self-batched alloys.

*Hardness/
 Indentation* Performed various hardness tests on bulk metallic and ceramic samples utilizing a **Hysitron TI Premier Nanoindenter** as well as worked with various **Vickers, Rockwell, and Knoop Hardness Testers**.

Microscopy Microscopy skills include over 500 hours logged on utilizing and analyzing data from **Optical Microscopy, Scanning Electron Microscopy (SEM), Focused Ion Beam (FIB), and Transmission Electron Microscopy (TEM)**.

Spectroscopy Along with processing and mechanical testing, further skills including working with and analyzing spectra generated by various spectroscopy methods such as **UV-Vis Spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), Raman Spectroscopy, and X-Ray Diffraction (XRD)**.

<i>Thermal Analysis</i>	Thermal analysis techniques worked with previously include utilizing Linseis Dilatometer, Differential Thermal Analysis (DTA), Thermalgravimetric Analysis (TGA), and Differential Scanning Calorimetry (DSC) . Used these techniques to record thermal expansion data, thermomechanical behavior, and to record 1st and 2nd order phase transformations.
<i>Magnetic Susceptibility</i>	Performed extensive magnetic susceptibility and resistivity tests for varying temperatures and applied magnetic fields utilizing a SQUID Magnetometer for various paramagnetic and ferromagnetic semi-conductors.
<i>Fiber-Optics</i>	Worked with preparing, handling, strain coupling, and interrogating fiber-optics. Luna OBR and ODiSI Interrogation Systems .

LAB / SHOP EXPERIENCE

<i>Welding</i>	Previously worked to certify on flat and uphill welding. Some experience in overhead welding. Worked with SMAW, MIG, and TIG. Understanding in proper set-up and welding procedures.
<i>Machining</i>	Hands on experience with basic machining equipment such as lathes, steel saws, band saws, table saws, and mills. Other sectioning equipment include abrasive well saws, plasma cutters, diamond saws, and chop saws.
<i>Laboratory Etiquette</i>	Experienced in most laboratory settings. Includes: working with glassware, fume hoods, open flames, acids and bases, and solvents. Can demonstrate basic knowledge with lab procedures such as wearing proper PPE, consulting safety data sheets (SDS), controlling chemical spills and waste, etc.
<i>Metallography</i>	Extensive hands-on experience in metallographic preparation starting from proper sectioning of samples to producing scratch-free mirror surface finishes. Worked with polishing Ti-, Mo-, W-, Al-, Mg-, Cu-, Fe-, and Ni-based alloys. Softest and hardest material prepared were pure Cu and CM247 Ni-based superalloy, respectively.
<i>Heat Treatment</i>	Worked with a variety of high and low temperature furnaces to carry out heat treatments. Understanding includes oxidation characteristics of metals and choosing proper atmosphere or inert environments to carry out heat treatments. Moreover, have had to design and carry out heat treatment optimizations for Ni-, Al-, and Mg-based alloys, comparing differences in microstructural observations and mechanical properties.
<i>Interests</i>	Welding · Cooking · Hiking · Baseball · Playing with the Pug

June 23, 2022