

William J. Costakis, Jr.
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EDUCATION

Purdue University, West Lafayette, IN August 2015 – Present
Thesis Research: *Processing of transparent ceramics via alignment of α -Al₂O₃ platelets for armor applications*
Doctorate of Philosophy, Materials Science and Engineering
GPA: 3.80/4.0

Purdue University, West Lafayette, IN August 2013 – May 2015
Bachelor of Science, Materials Science and Engineering
GPA: 3.63/4.0

Wabash College, Crawfordsville, IN August 2009 – May 2013
Bachelor of Arts, Major: Physics, Minor: Mathematics
GPA: 3.44/4.0

RESEARCH EXPERIENCE

Processing of transparent ceramics via alignment of α -Al₂O₃ platelets August 2017 – Present
Purdue University

- Working to create a robust approach to fabricate transparent alumina, developing a simple powder/polymer blending technique to make formable powders/polymer blends that develop shear and elongational flow stresses that can be used to align ceramic platelets
- Side Project: Developing highly loaded ceramic suspensions with oxide fibers/platelets to use with additive manufacturing processes on a Hyrel 3D printer in collaboration with researchers at NASA Glenn research center in Cleveland, OH

Development of UV-curable Ceramic (Boron Carbide, Silicon Carbide and Alumina) Suspensions for Stereo Lithography Based Additive Manufacturing May 2017 – August 2017
Army Research Laboratory

- Summer Internship: Worked to develop preliminary UV-curable ceramic suspensions for final use in stereo lithographic additive manufacturing process, developed highly loaded ceramic methacrylated suspensions, and provided proof of concept through use of suspensions in a Moonray printer
- Characterized powders through BET analysis and zeta potential, characterized ceramic suspensions through UV curing studies, thermal gravimetric analysis (TGA), and Fourier-transform infrared spectroscopy (FTIR)
- Competed in the final round of the ARL Armor branch “summer research presentation competition”

Processing and Mechanical Evaluations of Sintered (without the use of pressure) Ultra-High Temperature Ceramic Composites August 2015 – August 2017
Purdue University

- Developed processing science to fabricate UHTCCs capable of >1500°C service, without the use of an externally applied load during sintering, that demonstrate the requisite energy absorbing properties required of a composite structure and a flexure strength of 300 MPa

Additive Manufacturing of Boron Carbide via Continuous Filament Direct Ink Writing of Aqueous Ceramic Suspensions

May 2014 – August 2015

Army Educational Outreach Program and Army Research Office

- Selected to participate in Undergraduate Research Apprenticeship Program at Purdue University
- Established processing methods for highly loaded boron carbide ceramic suspensions, used additive manufacturing process to fabricate complex 3-dimensional structures out of new materials, characterized the rheological behavior of boron carbide suspensions along with microstructural and mechanical properties of robocast specimens
- Mentored student in the High School Apprenticeship Program, worked with team of graduate students on multiple projects, first author on the published article [1]

Physical Metallurgy of Selected Zirconium Alloys

August 2014 – May 2015

GE/Hitachi and Purdue University

- Conducted project to characterize and establish secondary phases of selected zirconium alloy for use in nuclear fuel channel systems, developed experimental heat treatment methods to model manufacturing process
- Obtained training and demonstrated competence to individually use multiple analytical and microstructural characterization techniques, such as SEM (scanning electron microscopy), TEM (transmission electron microscopy), STEM (scanning transmission electron microscopy) FIB (focused ion beam), TGA (thermal gravimetric analysis), DSC (differential scanning calorimetry), XRD (X-ray diffraction), and XRF (X-ray fluorescent), to properly obtain information on phases and structures
- Reported to a team of Global Nuclear Fuel and GE/Hitachi engineers, lead bi-monthly conference calls with sponsor and teammates, managed project by discussing tasks and organized samples for preparation and characterization

Fabrication of Complex-shaped Ceramic Components By Room-temperature Injection Molding of Ceramic Suspension Gels

August 2014 – May 2015

Purdue University

- Prepared and optimized highly loaded alumina ceramic suspensions for use in room temperature 3-D printing, worked with other students to construct fully enclosed complex three dimensional objects and substrates by using a dual injector printing program
- Employed computer code to enhance 3-D printer performance and to obtain desired printed samples, performed rheology tests to further characterize and optimize ceramic suspensions
- Funded by the Army Research Office (Grant #W911NF-13-1-0425), under the direction of Professors Rodney Trice and Jeffrey Youngblood, second author on the published article [2]

Construction of Direction Sensitive Scintillator-bar Muon Detector

January 2011 – May 2011

Wabash College

- Designed and fabricated experimental set up, helped write Monte-Carlo simulation in Wolfram Mathematica to model muon signal detection, collected data on time delay response between two muon pulses to identify the traveling direction and angle of muons

Acoustical Fracture Signals in Steel Reinforced Concrete Beams

August 2010 – January 2011

Wabash College

- Worked to predict failure by fracture in steel reinforced concrete beams through acoustic emission monitoring
- Developed standard procedure to mix and pour concrete beams, calibrated piezoelectric sensors and camera for analysis

Characterization of Spatial Light Modulator for Holographic Displays

August 2010 – January 2011

Wabash College

- Developed program based on Fourier transforms to make diffraction gratings with Spatial Light Modulator for manipulation of incident HeNe laser, analyzed multiple far field images to gauge the ability of the input and output functions

WORK EXPERIENCE

Materials Science and Engineering Teaching Assistant

January 2016 – May 2016

Purdue University, West Lafayette

- Assisted a sophomore level material science class titled “Structure and Properties of Materials”, individually taught and lead 2 separate recitation sessions each week consisting of roughly 40 students each
- Developed weekly quizzes, held office hours for 2 hours per week to further offer help with homework and difficult material, collaborated with the professor to grade homework assignments and exams

Metallurgical Engineer Internship

May 2014 – August 2014

Arcelor Mittal, Indiana Harbor

- Worked with Operations and Technology department at the 84’ Hot Strip Mill located at Indiana Harbor, assigned to a team composed of 7 engineers from the Quality, Research, and Operations and Technology departments to develop and propose an argument for an upgraded water cooling system, provided substantial evidence that coiling temperature requirements were not being fulfilled
- Characterized microstructure of new steel grade trial, performed stereographic techniques, and used an optical microscope and SEM (scanning electron microscope) to format a report for a group of research engineers
- Characterized the microstructure of new press hardening steel to be used in anti-intrusion automotive parts, presented and discussed findings with lead engineers at the global Research and Development department
- Developed a standard procedure to calibrate the X-ray gauge device, analyzed past data to collect steel grades with relative gauge errors, worked with lead research engineer to update the database of parent chemistries for new advanced steel grades

Physics Tutor

August 2012 – May 2013

Wabash College

- Taught the fundamentals of physics to students, established a comfortable learning environment, worked with other tutors to effectively convey concepts and ideas

Physics Grader

August 2011 – December 2013

Wabash College

- Graded physics homework 3 times a week, collaborated with the professor to ensure the proper grades were distributed

LEADERSHIP

ACerS’s President’s Council of Student Advisors (PCSA)

October 2016 – Present

- Working with a student-led committee to facilitate industry-student relations, promote ceramic science and engineering at the university and local levels, and implement ceramics-focused outreach activities on a national and international level

Programming Committee Member:

- Actively involved in the Programming committee (2016-2017), developing a new student run demonstration competition for graduate and undergraduate individuals and materials science student groups (MA or Keramos chapters, etc.), organizing the future creativity completion for MS&T2017

External Partnership Committee Member:

- Actively involved in the EPC committee (2017-2018), working as the liaison for the programing committee, relayed information to the committee on the organizing and planning of the 2018 winter workshop

2018 ACerS Winter Workshop Organizing Committee Member:

- Involved in the organizing and planning of the 2018 ACerS Winter Workshop, worked with a team of young professionals and the administrative staff to invite distinguished speakers from the different ceramic research fields to give talks to students and young professional ranging from bio, armor and transparent ceramics, as well as talks on professional networking and leadership skills

MSE Graduate Student Association

Outreach Co-Chair:

May 2016 – August 2017

- Organized, lead, and participated in materials science outreach events, presented materials science demonstrations to student programs such as the Minority Engineering Program, the Seminar for Top Engineering Prospects (STEP) Program, the 4-H community, and local schools
- Organized and collaborated with other engineering programs to host outreach events for Purdue's Spaceday and Nanodays programs
- Lead demonstrations to inform high school teachers on ways to integrate materials sciences projects into their course curriculum, created videos of educational demonstrations in multiple languages to accommodate a global student and teacher audience

Purdue Women in Engineering Program (WIEP)

May 2016 – August 2017

- Participating in the WIEP summer and fall ACCESS leadership program, leading hands on engineering activities at local summer programs (K-8th grade residential and day camps), encouraging younger children to participate in engineering based activities through interesting and challenging outreach activities
- Local summer programs included: Brothers Drive Kinder Care, Girl Scouts of Central Indiana, Hannah Center, Imagination Station, Lyn Treece Boys & Girls Clubs, McAllister Parks & Recreation, Murdock Elementary FOCUS Program, Purdue Athletes Life Success Program (PALS), YMCA, and YWCA

Purdue Climbing Club

President:

January 2016 – January 2017

- Organized and presided over all meetings and events, developed and implemented new weekly newsletters to effectively communicate with the entire club, planed weekly training sessions 4 times a week, scheduled and organized the semester competitions and activities

Treasurer:

January 2015 – January 2016

- Managed financial accounts, invited and arranged for guest speakers to come and talk about climbing culture, safety, and training, consulted with the executive board for improvement of the scheduled events and training, developing introductory classes to help transition new climbers from indoor to outdoor climbing

Vice President:

August 2015 – December 2015

- Worked to start a new climbing club at Purdue, organized bi-weekly training sessions, attended and competed in monthly competitions, hosted community climbing events each week, and recruited new students to become active members

Purdue University Materials Advantage

January 2014 – May 2015

Safety Chair:

- Organized subcommittee of students to inspect labs, worked with graduate students and professors to develop safety procedures and insure that the workspace was usable and safe for the introduction of new etchants, such as hydrofluoric acid

- Lead outreach events to introduce diverse groups of students (middle school and high school) to materials engineering, planned and performed hands on material science demonstrations, collaborated with Purdue Baja SAE club by offering materials solutions to real world problems

Wabash College Resident Assistant

March 2010- May 2013

- Managed resident hall floor consisting of 40 students, co-managed dormitory building containing 200 students, strengthened student participation in campus activities, built personal bonds through mentoring students
- Collaborated with other RAs to improve training tailored to specific problems involving alcohol and other substances
- Learned how to lead effectively through respect, tend to students with different backgrounds and needs by managing living units with differently orientated atmospheres each year

Wabash College Rugby Club

President:

August 2012 – May 2013

- Established a climate of enthusiasm through diverse practice activities, demonstrated leadership through student lead practices, requested input to explore alternatives before making important decisions and worked with the needs of the players
- Developed better communication skills through constant contact with league officials to better facilitate matches, gained respect from team members by demonstrating commitment and hard work

Treasurer:

December 2010 – May 2012

- Managed financial account, arranged for the purchase of new uniforms for the team, directed the affairs of the referees, consulted with the faculty advisor, president, and match coordinator for improvement of the schedule and allocations

Wabash College Malcolm X Institute of Black Studies

August 2011 – May 2012

KQ&K Tutoring and Mentoring Program Chair:

- Individually tutored and worked with 18 children from the Crawfordsville Elementary and Middle schools twice a week, co-organized transportation to and from the tutoring facilities

Academic Board Co-Chair:

- Provided academic support for members, worked with a group to academically involve students, developed quizzes to cognitively challenge others

W.A.R. Council (Wabash Acts Responsibly), Vice President

January 2009 – December 2010

Wabash College

- Organized campus wide events to influence students to make responsible choices with alcohol and other drugs, developed new ideas to inform students about drug abuse, such as Root Beer Socials, drunken driving simulator, and brew offs

MEMBERSHIPS

MSE Graduate Student Association (Outreach Volunteer)

Purdue University

August 2015 – Present

- Volunteering to lead and participate in outreach events consisting of materials science demonstrations presented to middle and high school students from programs such as the Minority Engineering Program's Summer Engineering Workshop, the Seminar for Top Engineering Prospects (STEP) program, the 4-H community, and MSE 190 students
- Giving laboratory tours for Purdue's Recruitment of Multi-Ethnic students interested in the Schools of Engineering (PROMISE), participated in Nanodays (campus wide event) that promoted science and engineering to K-12 and young female students

National Materials Advantage Member

Purdue University

August 2013 – Present

- Memberships in TMS, AIST, ACerS, and ASM
ACerS
- President's Council of Student Advisors (PCSA) October 2016 – Present

AFS (American Foundry Society), Member January 2014 – May 2015
Purdue University

- Participated in casting nights, plant tours, and casting competition

Alpha Phi Omega, Member August 2010 – May 2011
Wabash College

- Community service fraternity; Participated in community service projects consisting of blood drives, Special Olympics, and Habitat for Humanity

CONFERENCE ATTENDANCE

Materials Science and Technology (2013)	Montreal, Quebec
Materials Science and Technology (2014) – Student Monitor	Pittsburgh, PA
Materials Science and Technology (2015)	Columbus, OH
International Conference and Exposition on Advanced Ceramics and Composites (2016)	Daytona Beach, FL
Materials Science and Technology (2016) – PCSA Delegate	Salt Lake City, UT
Materials Science and Technology (2017) – PCSA Delegate	Pittsburgh, PA
International Conference and Exposition on Advanced Ceramics and Composites (2018)	Daytona Beach, FL

PROFESSIONAL DEVELOPMENT ACTIVITIES

Materials Advantage Congressional Visit Day (2015)	Washington, DC
ACer's Winter Workshop (2016)	Orlando/Daytona Beach, FL
Materials Advantage Congressional Visit Day (2016)	Washington, DC
ACer's Winter Workshop (2018)	Orlando/Daytona Beach, FL

POSTER/PRESENTATIONS

(2018) Andrew Schlup, **William Costakis Jr.**, Prof. Rodney Trice, Prof. Jeffrey Youngblood, "Aligning α -Alumina Platelets via Shear/Elongational Flows for Improved Transparency: Processing and Preliminary Results", Oral presentation at the 42th International Conference and Exposition on Advanced Ceramics and Composites (ICACC 2018), Daytona Beach, FL.

(2016) **W.J. Costakis Jr.**, L.M. Rueschhoff, A.A. McEachen, A.I. Diaz-Cano, J.P. Youngblood, R.W. Trice, "Additive Manufacturing of Boron Carbide via Continuous Filament Direct Ink Writing of Aqueous Ceramic Suspensions", Oral presentation at the 40th International Conference and Exposition on Advanced Ceramics and Composites (ICACC 2016), Daytona Beach, FL.

(2015) L. Rueschhoff*, **W. Costakis**, M. Michie, A. Diaz-Cano, J. Youngblood, R. Trice "Manufacturing Complex-Shaped Ceramic Components through Room-Temperature Robocasting of Ceramic Suspension Gels (CeraSGels)" Oral Presentation at MS&T, Columbus, OH.

(2012) M. J. Madsen, L. Rice, **W. Costakis Jr.**, "Characterization of Spatial Light Modulator for Holographic Displays" presented at The Wabash College Celebration of Student Research, Scholarship and Creative Work, Crawfordsville, IN.

(2013) J. Brown, B. Foster, **W. Costakis Jr**, Y. Tang “Construction of Direction Sensitive Scintillator-bar Muon Detector” presented at The Wabash College Celebration of Student Research, Scholarship and Creative Work, Crawfordsville, IN.

RESEARCH PAPERS

- [1] **W.J. Costakis**, L.M. Rueschhoff, A.I. Diaz-Cano, J.P. Youngblood, R.W. Trice, Additive manufacturing of boron carbide via continuous filament direct ink writing of aqueous ceramic suspensions, *J. Eur. Ceram. Soc.* 36 (2016) 3249–3256.
- [2] L.M. Rueschhoff, **W.J. Costakis**, M.J. Michie, J.P. Youngblood, R.W. Trice, Additive Manufacturing of Dense Ceramic Parts via Direct Ink Writing of Aqueous Alumina Suspensions, *Int. J. Appl. Ceram. Technol.* (2016).