

CHARLES AMOS

charles.amos@inl.int
www.linkedin.com/in/charles-amos

EDUCATION

The University of Texas at Austin 2010-2017
Austin, Texas, USA
Doctor of Philosophy: Materials Science and Engineering
Advisors: Dr. John B. Goodenough and Dr. Paulo J. Ferreira
Dissertation: "Effect of Chemical Treatment and Trivalent Doping on the Surface Structure and Surface Chemistry of $\text{Li}_{1-x}\text{Ni}_{0.5-y}\text{Mn}_{1.5+y}\text{O}_4$ Spinel"
Overall GPA: 3.67 (4.0 Scale)

The University of West Florida 2005-2009
Pensacola, Florida, USA
Bachelor of Science: Physics
Major GPA: 3.92 (4.0 scale). Overall GPA: 3.89 (4.0 Scale)
Bachelor of Science: Mathematics
Major GPA: 3.91 (4.0 scale). Overall GPA: 3.89 (4.0 Scale)

HONORS AND ACHIEVEMENTS

NASA Space Technology Research Fellowship 2012-2016
The University of Texas at Austin

Doctoral Portfolio Program Certification in Nanoscience and Nanotechnology 2010-2017
The University of Texas at Austin
Recognition of students who obtain the broad educational background necessary to become leaders in nanoscience and nanotechnology

Engineering Foundation Endowed Graduate University Fellowship 2016-2017
The University of Texas at Austin

Engineering Foundation Endowed Graduate Presidential Scholarship 2013-2014
The University of Texas at Austin

John and Mary Booker Endowed Graduate Fellowship 2011-2012
The University of Texas at Austin

Engineering Foundation Endowed Graduate Fellowship 2010-2011
The University of Texas at Austin

Member of Electrochemical Society 2013
The University of Texas at Austin

Nomination for Best Poster 2012
Fall MRS Meeting for "Understanding the Role of Mn in the Superior Performance of $\text{LiNi}_{0.5-x}\text{Mn}_{1.5+x}\text{O}_4$ Spinel Cathodes for Li-ion Batteries"

Florida Academic Scholars Award 2005-2009
The University of West Florida

John C. Pace Honors Scholarship for Academic Excellence The University of West Florida	2009
Outstanding Physics Student The University of West Florida	2009
President's Honored List for Academic Excellence The University of West Florida	2008
Dean's Honored List for Academic Excellence The University of West Florida	2008
Vice President of Society of Physics Students (SPS) UWF Chapter The University of West Florida	2007

RESEARCH EXPERIENCE

Areas of expertise

- Materials Science and Engineering
- Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM)
- Electrochemistry: Batteries, Fuel Cells, Flow Batteries
- Li-ion Cathode Synthesis
- Structural and Chemical Characterization
- Nanotechnology

International Iberian Nanotechnology Laboratory **August 2018 – Present**
Advanced Electron Microscopy Imaging and Spectroscopy (AEMIS) Department
Atomic Structure – Composition of Materials Group
Postdoc Researcher – Research Fellow
Braga, Braga, Portugal

- Applying advanced transmission electron microscopy techniques toward materials problems in electrochemical systems with an emphasis on lithium-ion batteries and fuel cells

The University of Texas at Austin **2011 – 2017**
Graduate Research Assistant – Electrochemistry
Austin, Texas, USA

- Lithium-Ion Batteries
- Synthesis of lithium-ion and sodium-ion cathode materials, including spinel, layered, olivine, and hexacyanoferrates, with various techniques e.g. solid-state, hydrothermal, co-precipitation, and sol-gel
- Assembly of coin cell batteries and electrochemical testing with ARBIN and LAND battery testers
- Structural characterization of electrode materials with Philips XRD Diffractometer and Rigaku MiniFlex
- Additional characterization techniques include thermal gravimetric analysis (TGA), differential scanning calorimetry (DSC), powder x-ray diffraction (XRD), and scanning electron microscopy (SEM)
- Analysis of XRD spectra with Jade, FullProf and PDXL-2 Refinement Software
- Flow Batteries
- Inorganic Electrolyte

The University of Texas at Austin **2011 – 2017**
Graduate Research Assistant - Transmission Electron Microscopy
Austin, Texas, USA

- Advanced Transmission Electron Microscopy (TEM)

- Structural and chemical characterization of lithium-ion cathode materials with advanced TEM techniques on JEOL 2010F and aberration-corrected electron microscopes including: JEOL ARM 200F, NION UltraSTEM100 and FEI Titan
- Techniques include conventional TEM, aberration-corrected high-angle annular dark field (HAADF), scanning TEM (STEM), annular bright field (ABF) STEM, diffraction-STEM (D-STEM, developed in Ferreira Lab) and selected-area electron diffraction (SAD)
- Chemical techniques include energy-dispersive x-ray spectroscopy (EDS/EDX/XEDS), and electron energy loss spectroscopy (EELS)
- Experience with Diamond Crystal and Molecular Structure Visualization software used for structural visualizations and HREM software used for HAADF and ABF STEM simulations
- Familiar with low-dose STEM procedure, which reduces electron beam intensity in order to minimize damage of transition metal oxide sample under imaging conditions

International Iberian Nanotechnology Laboratory **2017**

Visiting Researcher

Braga, Braga, Portugal

- Measurements with HAADF STEM and EELS on chemically-treated and trivalently-doped $\text{Li}_{1-x}\text{Ni}_{0.5-y}\text{Mn}_{1.5+y}\text{O}_4$ spinels used as cathodes for Li-ion batteries.

Oak Ridge National Laboratory **2015**

Summer Internship

Oak Ridge, Tennessee, USA

- Measurements with HAADF STEM, EELS, X-ray diffraction (XRD), TEM training, and synthesis experiments.

Oak Ridge National Laboratory **2014**

Summer Internship

Oak Ridge, Tennessee, USA

- Measurements with HAADF STEM, EELS, X-ray diffraction (XRD), TEM training, and synthesis experiments.

NASA's Jet Propulsion Laboratory **2013**

Summer Internship

Pasadena, California, USA

- Research internship, which included learning electrochemical impedance spectroscopy as well as advanced battery assembly techniques.

The University of Texas at Austin **2010 – 2011**

Graduate Research Assistant

Austin, Texas, USA

- Graphene Synthesis and Characterization
- Analysis of the thermal conductivity of monolayer graphene with Witec Micro-Raman Alpha300 Spectrometer
- Exploration of the growth mechanisms of graphene on various metal substrates including chemical vapor deposition on copper and resistive and RF heating of nickel substrates
- Research on the mechanical properties of monolayer graphene films with maximum pressure burst technique

IBM Almaden Research Center **2009**

Research Experience for Undergraduate

San Jose, California, USA

- Research Internship through Stanford's Center on Polymer Interfaces and Macromolecular Assemblies (CPIMA) program which included MATLAB simulation work on Characterization and Optimization of Phase Change Memory through Heat Transfer Analysis

**The University of West Florida
Pensacola, Florida, USA
Undergraduate Project**

2009

- Proseminar independent research project studying the practicality of Wireless Power Transfer through Capacitive Coupling

**The University of West Florida
Pensacola, Florida, USA
Undergraduate Research**

2007 – 2009

- Coherent Anti-Stokes Raman Spectroscopic analysis of DCVJ charge transfer molecular rotor
- Analysis of thin films of liquid crystals using Langmuir-Blodgett deposition techniques
- Study of nonlinear optical effects via phase conjugation in liquid crystals
- Analysis of thermal effects on the capacitance of liquid crystals
- Developed educational experiment involving non-intuitive experimental results with non-conservative electric field: An application of Gauss's Law and Faraday's Law.

WORK EXPERIENCE

**Race Service Specialist
Winding Road Racing
Austin, Texas, USA**

2016 – 2018

- Assembly, testing, sale, support, and maintenance of high-performance race cars
- Assembly and testing of National Auto Sport Association Prototype (NP01) race car
- Carry out general maintenance/repair of high-performance race cars including Global Mazda MX-5 Cup car, NP01 race car, DP02 race car, Spec MX-5 and MX-5 club cars.
- Perform light fabrication, composite work, and assembly of performance components
- Perform race car setup, including alignment, tire mounting/balancing, and fluid changes
- Provide trackside support including setup, tire changing, monitoring of tire pressures and temperatures as well as general repair of race cars

LABORATORY SKILLS and TECHNIQUES

Equipment

- Aberration-corrected NION UltraSTEM100
- Aberration-corrected JEOL ARM200F
- Aberration-corrected FEI Titan (Themis and Chemistem)
- JEOL 2010F
- Hitachi S-5500 Scanning Electron Microscope (SEM)
- FEI Quanta 600F SEM
- Veeco Wyko NT9100 Optical Profilometer
- Denton Thermal Evaporation: Thermal, RF, E-beam
- Oxford Instruments Plasma Lab 80+
- Suss MA6 Mask Aligner Photolithography Instrument
- Plasma-Therm 790 Reactive Ion Etching (RIE)
- Disco 321 Wafer Dicing Saw
- Class 1000 and 100 Cleanrooms
- Deposition (PECVD)
- Box/Batch/Tube Furnaces

Software

- C++
- MATLAB
- Labview

- SolidWorks 2010
- Digital Micrograph
- Origin
- Adobe Illustrator
- PDXL2
- Hyperspy PCA/ICA with Python
- OrCAD/PSpice (Circuit Analysis/Design)

Mechanical

- Adept at MIG Welding
- Some experience with CNC machining
- Extensive experience with precision measurement instruments, hand tools, and power tools
- Automotive maintenance, repair, restoration, and high-performance modifications

TEACHING EXPERIENCE

International Iberian Nanotechnology Laboratory

2017

Assistance in the Course: "Electron Microscopy Course: Theory and Practical Sessions-TEM, SEM, FIB"
Braga, Braga, Portugal

University of West Florida

2008-2009

Class Teaching: General Physics
Pensacola, Florida, USA

Other teaching experience

2005-2009

Tutoring and teaching undergraduate physics students

Laboratory Aide responsible for distributing and constructing physics experiments

Volunteer work including judging for middle and high school science fairs.

Hosting major fairs for potential students to pique interest in the sciences, particularly applied physics

PUBLICATIONS

9. **Amos, C.**, Roldan, M. A., Goodenough, J. B., Ferreira, P. J. "Effect of Chemical Treatment on the Surface Structure of $\text{Li}_{1-x}[\text{Mn}_2]\text{O}_4$," Submitted to ACS Nano (2017).
8. **CD Amos**, MA Roldan, M Varela, JB Goodenough, PJ Ferreira, "Revealing the Reconstructed Surface of $\text{Li}[\text{Mn}_2]\text{O}_4$ ", Nano letters (2016) 16 (5), 2899-2906. DOI: 10.1021/acs.nanolett.5b03926
7. **CD Amos**, PJ Ferreira, JB Goodenough, "Imaging the Surface of LiMn_2O_4 with Low-Dose STEM", ECS Meeting Abstracts, (2016) 2,160-160
6. **C Amos**, MA Roldan, M Varela, JB Goodenough, PJ Ferreira, "Understanding the Surface Structure of LiMn_2O_4 Spinel Cathodes with Aberration-Corrected HAADF STEM and EELS", Microscopy and Microanalysis (2015) 21, 1375
5. **CD Amos**, J Song, PJ Ferreira, JB Goodenough, "Understanding the Surface Structure of $\text{LiNi}_{0.45}\text{Mn}_{1.55}\text{O}_4$ Spinel Cathodes with Aberration-Corrected HAADF STEM", Meeting Abstracts (2014), 5, 465-465.

4. **C Amos**, J Song, K Jarvis, J Goodenough, PJ Ferreira, "Understanding the Superior Performance of LiNi_{0.5}-XMn_{1.5} Spinel Cathodes with Advanced Electron Microscopy", *Microsc. Microanal* 19, 2 (2013). doi:10.1017/S1431927613009434
3. Song, J., Shin, D. W., Lu, Y., **Amos, C. D.**, Manthiram, A., Goodenough, J. B., "Role of Oxygen Vacancies on the Performance of Li[Ni_{0.5}-xMn_{1.5+x}]O₄ (x=0, 0.05, 0.08) Spinel Cathodes for Lithium-Ion Batteries", *Chem. Mater.* (2012), 24, 3101-3109. dx.doi.org/10.1021/cm301825h
2. Jie Song, **Charles D Amos**, Yuhao Lu, Jinguang Cheng, John B Goodenough, "Investigation of Trivalent Cationic Substitution of 5V Cathode Materials for Lithium-Ion Batteries", *Meeting Abstracts* (2012), 7, 395-395.
1. Chen, S., Moore, A. L., Cai, W., Suk, J. W., An, J., Mishra, C., **Amos, C.**, Magnuson, C., Kang, J., Shi, L., Ruoff, R. S., "Raman Measurements of Thermal Transport in Suspended Monolayer Graphene of Variable Sizes in Vacuum and Gaseous Environments", *ACS Nano* (2011), 5, 321-328. DOI: 10.1021/nn102915x

RELATED PROFESSIONAL EXPERIENCE

Department of Defense

2006–2009

- Student Aide responsible for data entry and management
- Inventory work for various warehouses and offices
- Maintenance work and device removal/relocation

CONFERENCE CONTRIBUTIONS

Charles Amos, J. Song, J. B. Goodenough, P. J. Ferreira, Oral Presentation: "Understanding the Surface Structure of LiMn₂O₄ Spinel Cathodes with Aberration-Corrected HAADF STEM and EELS," *Microscopy and Microanalysis (M&M)*, Portland, Oregon, 2015.

Charles Amos, J. Song, K. Jarvis, J. B. Goodenough, P. J. Ferreira, Poster Presentation: "Understanding the Surface Structure of LiNi_{0.45}Mn_{1.55}O₄ Spinel Cathodes with Aberration-Corrected HAADF STEM," *Frontiers of Electron Microscopy in Materials Science (FEMMS)*, Lake Tahoe, California, 2015.

Charles Amos, J. B. Goodenough, P. J. Ferreira, Oral Presentation: "Understanding the Surface Structure of LiMn₂O₄ Spinel Cathodes with Aberration-Corrected HAADF STEM and EELS," *International Materials Research Congress (IMRC)*, Cancun, Mexico, 2015.

Charles Amos, J. B. Goodenough, P. J. Ferreira, Oral Presentation: "Understanding the Surface Structure of Li-Mn-Based Spinel Cathodes with Aberration-Corrected HAADF STEM and EELS," *Hydro Quebec/McGill University*, Montreal, Canada, 2014.

Charles Amos, J. Song, K. Jarvis, J. B. Goodenough, P. J. Ferreira, Oral Presentation: "Understanding the Surface Structure of LiNi_{0.45}Mn_{1.55}O₄ Spinel Cathodes with Aberration-Corrected HAADF STEM," *Microscopy and Microanalysis*, Hartford, Connecticut, 2014.

Charles Amos, J. Song, J. B. Goodenough, P. J. Ferreira, Poster Presentation: "Understanding the Surface Structure of LiNi_{0.45}Mn_{1.55}O₄ Spinel Cathodes with Aberration-Corrected HAADF STEM," *International Materials Research Congress*, Cancun, Mexico, 2014.

Charles Amos, J. Song, J. B. Goodenough, P. J. Ferreira, Poster Presentation: "Understanding the Surface Structure of LiNi_{0.45}Mn_{1.55}O₄ Spinel Cathodes with Aberration-Corrected HAADF STEM," *International Microscopy Congress*, Prague, Czech Republic, 2014.

Charles Amos, J. Song, J. B. Goodenough, P. J. Ferreira, Oral Presentation: “Understanding the Surface Structure of $\text{LiNi}_{0.45}\text{Mn}_{1.55}\text{O}_4$ Spinel Cathodes with Aberration-Corrected HAADF STEM”, The Electrochemical Society Fall Meeting, Cancun, Mexico, 2014.

Charles Amos, J. Song, K. Jarvis, J. B. Goodenough, P. J. Ferreira, Oral Presentation: “Understanding the Superior Performance of $\text{LiNi}_{0.5}\text{-XMn}_{1.5}\text{+XO}_4$ Spinel Cathodes with Advanced Electron Microscopy,” P02.06 Structure and Composition Analysis of Nanoparticulate Systems, Microscopy and Microanalysis, Conference, Indianapolis, Indiana, 2013.

Charles Amos, J. Song, K. Jarvis, J. B. Goodenough, P. J. Ferreira, Poster Presentation: “Understanding the Role of Mn in the Superior Performance of $\text{LiNi}_{0.5}\text{-xMn}_{1.5}\text{+xO}_4$ Spinel Cathodes for Li-ion Batteries,” J8.07, Symposium J: Materials Aspects of Advanced Lithium Batteries, MRS Fall Meeting & Exhibit, Boston, Massachusetts, 2012.

OTHER SKILLS

Languages

- English – Mother tongue
- Spanish – Basic

Other interests

- Alternative Energy Sources
- Batteries
- Fuel Cells
- Electric Vehicles
- Motorsports
- Football
- Baseball
- Automotive Maintenance, Repair, and Restoration