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Erick Leonel Espinosa Villatoro

EDUCATION

- ◇ **Ph.D. in Material Science** **01/2017 - 06/2021**
Institute of Physics, Benemérita Universidad Autónoma de Puebla, Puebla, Mexico.
Thesis: Effect of pre-conditioning of Si anodes by sodiation in their performance in Li ion batteries.
CONACyT Scholarship.
Thesis Director: Dr. Enrique Quiroga González
- ◇ **M.Sc. in Material Science** **08/2015 - 12/2016**
Institute of Physics, Benemérita Universidad Autónoma de Puebla, Puebla, Mexico.
CONACyT Scholarship.
- ◇ **B.E. Energy Engineering** **08/2011 - 12/2014**
Universidad Politécnica de Chiapas, Suchiapa, Chiapas, Mexico.

PROFESSIONAL

- ◇ **Postdoctoral Scholar** **08/2022 - Ongoing**
Stanford Synchrotron Radiation Lightsource, SLAC National Accelerator Laboratory, Menlo Park, California.
Project: X-rays to characterize high-energy, low cost Li-metal batteries for the next generation energy storage for electric vehicles. Battery chemistries may include Li||NMC and Li||S. And X-ray characterization of Li-ion cells during extreme fast charging to investigate the impacts of proposed solutions to increasing fast charging performance.
P.I. Dr. Johanna Nelson Weker
- ◇ **Postdoctoral Researcher** **11/2021 - 04/2022**
Instituto de Investigaciones en Materiales, Universidad Nacional Autónoma de México,

Mexico City, Mexico.

Project: Research and synthesis of ceramic materials of formula NaMO_2 , where $M = \text{Fe}$ and Mn .

P.I. Dr. Heriberto Pfeiffer Perea

- ◇ **Energy Engineer** **06/2021 - 10/2021**
Aqua Irrigacion, San Miguel Zacaola, Puebla.
Activities: Electrical and hydraulic pumps installations, photovoltaic solar systems design and installations.

- ◇ **Teacher** **08/2020 - 06/2021**
Instituto Interactivo Alfred Binet, San Andrés Cholula, Puebla.
Courses: Sciences (Math and Physics).

- ◇ **Teaching assistant** **01/2018 - 04/2018**
Institute of Physics, Benemérita Universidad Autónoma de Puebla, Puebla, Mexico.
Provided support in Thermal Physics.

- ◇ **Teaching assistant** **01/2017 - 07/2017**
Institute of Physics, Benemérita Universidad Autónoma de Puebla, Puebla, Mexico.
Provided support in General Physics, Thermal Physics.

- ◇ **Interim Teacher** **01/2015 - 07/2015**
Secondary School # 145, El Pozo, Chiapas.
Courses: Sciences II and III (Physics and Chemistry).

- ◇ **Professional Internship** **09/2014 - 12/2014**
Institute of Physics, Benemérita Universidad Autónoma de Puebla, Puebla, Mexico.
Energy Laboratory
Activities: Assembly and start-up of ultrasonic pyrolytic spray equipment from Energy Laboratory at Institute of Physics, BUAP.

RESEARCH INTERESTS

- Si anodes
- Li-metal batteries
- NMC cathodes
- Li-ion, Na-ion batteries
- Synchrotron radiation characterization
- Synchrotron data analysis
- Micro X-ray Fluorescence Spectroscopy (μ -XRF)
- Micro X-ray Absorption Near Edge Structure (μ -XANES)
- Extended X-ray Absorption Fine Estructure characterization (EXAFS)
- X-ray Diffraction (XRD)
- Laser Ablation Laser Ionization Mass Spectrometry (LALI-TOF-MS)
- Energy storage and conversion

- Electrochemical characterization of materials
- Impedance spectroscopy characterization
- Morphological characterization of materials
- Programming: Python, MatLab
- Cryogenic Electron Microscopy
- DFT simulations
- Complex Systems
- Catalysis
- Adsorption or sorption processes
- Fuel cells

PUBLICATIONS

1. **E. Espinosa-Villatoro**, J. Nelson Weker, J. S. Ko, E. Quiroga-González, "Tracking the evolution of processes occurring in silicon anodes in lithium ion batteries by 3D visualization of relaxation times", *J. Electroanal. Chem.*, **892** (2021) 115309. DOI: 10.1016/j.jelechem.2021.115309.
2. V. Aca-López, **E. Espinosa-Villatoro**, J. D. Garay Marín, O. Pérez Díaz, E. Quiroga-González (2025), "Sustentabilidad Energética con Tecnologías de Almacenamiento Electroquímico" (pp. 135-161), In E. Gómez Arias, E. Cervantes Rendón, A. Rodríguez Martínez (Eds.), *Sustentabilidad Energética, Medioambiente y Sociedad: Avances en la Agenda 2030*. El Colegio de Chihuahua (CICESE). ISBN: 978-607-8214-82-2. Link: [Sustentabilidad Energética, Medioambiente y Sociedad](#).
3. Ángel M. Gómez-Coronel, Sofia Barba, **Erick Espinosa-Villatoro**, Jesús Muñoz Soria, Johanna Nelson Weker, Edgar G. Villabona-Leal, Joazeth Hiram, Javier Alanis Pérez, Maritza I. Pérez, "Crystalline Structure-Dependent Performance of Sodium Titanates as Anodic Materials in Li-ion Batteries: A Comparative Study Using Experimental and First Principle Analysis", (Submitted).
4. **Erick Espinosa-Villatoro**, Daniel G. Araiza, Heriberto Pfeiffer, "Exploring the capture and catalytic properties of sodium manganates: bifunctional ceramics for CO/CO₂ chemisorption and CO oxidation", (Submitted to Chemical Engineering Journal).

CONFERENCES AND EVENTS

- ◇ **2025 SSRL/LCLS Users' Meeting, SLAC National Accelerator Laboratory, Menlo Park, United States**
Poster presentation
Tracking transition-metal crossover and SEI growth in Li||high-Ni cathodes via synchrotron techniques
- ◇ **PRiME 2024 ECS, Hawai'i, United States**
Talk presentation

Insights into the Performance Enhancement of Co and Mn Doped LiNiO₂ Cathodes Using Synchrotron Techniques.

- ◇ **Vehicle Technologies Office Annual Review 2024, Arlington, Virginia, United States**
Attendee
- ◇ **Energy Storage Discussions 2023, Monterrey, Mexico**
Talk presentation
Synchrotron radiation insights into LiNiO₂ and Mn, Co-doped cathodes at different states of charge via TXM and XANES analysis.
- ◇ **2023 SSRL/LCLS Users' Meeting, SLAC National Accelerator Laboratory, Menlo Park, United States**
Poster presentation
Synchrotron X-ray studies reveal extreme fast charging effects on NMC811 Li-ion battery cathodes.
- ◇ **Clubes de Ciencia Mexico 2023, Xalapa, Veracruz, Mexico**
Instructor
Ampere's Amps: El poder de la electroquímica
- ◇ **XI International Workshop on Energy Conversion and Storage, Mexico City, Mexico**
Workshop Speaker
Synchrotron light to uncover changes in the Si anodes of Li-ion batteries preconditioned with Na.
- ◇ **International Materials Research Congress 2022, Cancun, Mexico**
Poster presentation
NaFe_xMn_yO₂ as cathode material for lithium-ion batteries.
- ◇ **International Materials Research Congress 2022, Cancun, Mexico**
Poster presentation
The influence of the crystalline phase in the electrochemical performance of NaFeO₂-based cathodes for lithium-ion batteries.
- ◇ **International Materials Research Congress 2021, Cancun, Mexico**
Poster presentation
Effect of Na-preconditioning in the properties of silicon anodes for Li-ion batteries.
- ◇ **I Congreso Nacional de la Sociedad Mexicana de Luz Sincrotrón - I Congreso Internacional de Técnicas de Luz Sincrotrón, Guanajuato, Mexico.**
"First Place" Dr. Fernando Matías Moreno Yntriago Award in Poster presentation
Study of the chemical, morphological and structural characteristics of Na-preconditioned Si anodes for lithium-ion batteries by synchrotron techniques.

- ◇ **IV Simposio Interdisciplinario en Materiales 2021, Capítulo Estudiantil CINVESTAV-Zacatenco, Mexico City, Mexico.**
 Poster presentation
 Synchrotron chemical and structural analysis of Na-preconditioned silicon anodes for Li-ion batteries.

- ◇ **LXIII Congreso Nacional de Física 2020, Online, Mexico**
 Attendee

- ◇ **Energy Storage Discussions 2019, Mexico City, Mexico**
 Talk presentation
 Effect of Na-preconditioning of silicon anodes for Li-ion batteries.

- ◇ **2019 SSRL/LCLS Users' meeting, SLAC National Accelerator Laboratory, California, United States**
 Poster presentation
 Synchrotron light to reveal changes in Si anodes of Li-ion batteries submitted to a Na preconditioning process.

- ◇ **LXI Congreso Nacional de Física 2018, Puebla, Mexico**
 Poster presentation
 Pre-conditioning of silicon anodes by sodiation for lithium-ion batteries.

- ◇ **International Materials Research Congress 2018, Cancun, Mexico**
 Poster presentation
 Pre-conditioning of silicon anodes by sodiation for lithium-ion batteries.

- ◇ **Baja Dimensionalidad 2018, Puebla, Mexico**
 Poster presentation
 Efecto del pre-acondicionamiento mediante sodiación en ánodos de Si para baterías de ion Li.

- ◇ **Energy Storage Discussions 2017, Puebla, Mexico**
 Poster presentation
 Pre-conditioning of silicon anodes by sodiation for lithium-ion batteries.

- ◇ **Transporte Eléctrico, Innovación tecnológica, oportunidades de inversión y desarrollo para la industria 2017, Cuernavaca, Mexico**
 Instituto Nacional de Electricidad y Energías Limpias
 Participation

- ◇ **Energy Storage Discussions 2016, Puebla, Mexico**
 Participation
 Logistic Support

COURSES AND DIPLOMAS

- ◇ **6th US School on Total Scattering Analysis**
Jun 2024
Oak Ridge National Laboratory, Oak Ridge, Tennessee, United States.
- ◇ **IX International Workshop on Energy Conversion and Storage 2020**
Oct 2020
CICATA-Legaria, Instituto Politécnico Nacional, Mexico City, Mexico.
- ◇ **Fundamentos de la Microscopía Electrónica de Barrido y EDS**
Oct 2020
El capítulo estudiantil CINVESTAV-Zacatenco, la Sociedad Mexicana de Materiales y JEOL México, Mexico City, Mexico.
- ◇ **Workshop Battery Simulation**
Oct 2019
ESFM (ESD2019), Insituto Politécnico Nacional, Mexico City, Mexico.
- ◇ **Workshop Supercapacitors**
Oct 2019
ESFM (ESD2019), Insituto Politécnico Nacional, Mexico City, Mexico.
- ◇ **Diplomate in Complex Systems**
Feb 2018 - May 2018
Faculty of Biological Science, Benemérita Universidad Autónoma de Puebla, Puebla, Mexico.
- ◇ **Science Journalism Workshop**
Jun 2017
Institute of Physics, Benemérita Universidad Autónoma de Puebla, Puebla, Mexico.

SKILLS

- ◇ Demonstrated teamwork, self-learning initiative, and good computer skills throughout the research projects.
- ◇ Communicated effectively with supervisors, collaborators, and peers in oral and written forms.
- ◇ Conducted advanced characterization with synchrotron radiation for *ex-situ* and *operando* experiments at SSRL (TXM, XRD, μ -XRF, μ -XAS), also STXM and Ptychography techniques at ALS beamline 7.0.1 (COSMIC).
- ◇ Performed X-ray computed tomography to obtain 3D images of the internal structure of samples.

- ◇ Quantitative and qualitative elemental analysis and elemental mapping using Laser Ablation Laser Ionization Mass Spectrometer (LALI-MS).
- ◇ Performed quality control and optimization of synthesis parameters using Mass Spectrometer and Thermogravimetric Equipment.
- ◇ Analyzed the structural, morphological, and compositional properties of synthesized samples using lab X-Ray Diffractometer (Rigaku, Siemens, PANalytical Empyrean), Surface Analysis (SEM, AFM, XPS), Electrical Characterization and Semiconductors techniques.
- ◇ Interpreted and reported the characterization results using data analysis software for each technique.
- ◇ Synthesized Na and Li-based samples (sodium manganates and ferrites) using co-precipitation and solid-state synthesis methods for energy storage, capture and oxidation applications.
- ◇ Programmed in Python and MatLab languages for data analysis, visualization, and automation of tasks.
- ◇ Performed electrochemical analysis and characterization of synthesized samples using cyclic voltammetry, electrochemical impedance spectroscopy, galvanostatic tests, and others.
- ◇ Evaluated the electrochemical performance and stability of samples for energy storage applications.

LANGUAGES

Spanish: Native

English: Fluent

REFERENCES

- ◇ Johanna Nelson Weker, Ph.D.
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- ◇ Jagjit Nanda, Ph.D.
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I, at this moment, declare that all information contained in this curriculum vitae is factually correct and complete.