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# Erick Leonel Espinosa Villatoro

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## 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 - 03/2026**
  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 = 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 (XRD, XAS, TXM, XRF)
- Synchrotron data analysis
– Laser Ablation Laser Ionization Mass Spectrometry (LALI-TOF-MS)
- Energy storage and conversion
- Electrochemical characterization of materials
- Morphological characterization of materials (SEM, AFM, TEM)
- Cryogenic Electron Microscopy
– Catalysis
- Adsorption or sorption processes

## PUBLICATIONS

1. **Erick Espinosa-Villatoro**, Sofia Barba, Ángel M. Gómez-Coronel, Johanna Nelson Weker, Edgar G. Villabona-Leal, Eduardo Ramos-Díaz, Joazeth Hiram, Maritza I. Pérez, Javier Alanis Pérez, "Crystalline Structure-Dependent Performance of Sodium Titanates as Anodes for Li-ion Batteries", *Submitted to Journal of Electroanalytical Chemistry*.

2. **Erick Espinosa-Villatoro**, Otavio Marques, Zehao Cui, Penny Hyde, Zhiling Liang, Molleigh Preefer, Kevin Stone, Arumugam Manthiram, Johanna Nelson Weker, "Disentangling the Role of Al, Co, and

Mn Dopants in $LiNiO_2$ Cathodes *via* Synchrotron-Based Probes", *Submitted to Journal of Materials Chemistry A*.
DOI: –.

3. **Erick Espinosa-Villatoro**, Daniel G. Araiza, Heriberto Pfeiffer, "Exploring the capture and catalytic properties of sodium manganates: bifunctional ceramics for $CO/CO_2$ chemisorption and CO oxidation", *J. Environmental Management*, **401** (2026) 129026.
DOI: 10.1016/j.jenvman.2026.129026.

4. V. Aca-López, **E. Espinosa-Villatoro**, J. D. Garay Marín, O. Pérez Díaz, E. Quiroga- González (2025), "Sustentabilidad Energética con Tecnologías de Almacenamiento Elec- troquímico" (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.

5. **Erick Espinosa-Villatoro**, Johanna Nelson Weker, Jesse S. Ko, Enrique Quiroga-González, "Tracking the evolution of processes ocurring 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.

**CONFERENCES AND EVENTS**

- **2025 MRS Fall Meeting and Exhibit, Hynes Convention Center, Boston, Massachusetts, United States**
  Talk presentation
  Exploring the interplay between transition-metal crossover and SEI growth in Li||high-Ni cathode half-cells

- **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 $LiNiO_2$ 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 $LiNiO_2$ 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
  $NaFe_xMn_yO_2$ 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 $NaFeO_2$-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**
  Atendee

- **Energy Storage Disscusions 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-condiotioning 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 Disscusions 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 Disscusions 2016, Puebla, Mexico**
  Participation
  Logistic Support

**COURSES AND DIPLOMAS**

- **6$^{th}$ 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 Mexiacana 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 strong teamwork, self-directed learning, and advanced computational skills across multidisciplinary research projects.
- ◇ Communicated complex scientific results clearly and effectively to supervisors, collaborators, and peers through written reports, presentations, and publications.
- ◇ Performed advanced synchrotron characterization for *ex-situ* and *operando* studies at SSRL (TXM, XRD, $\mu$-XRF, $\mu$-XAS) and at ALS beamline 7.0.1 (COSMIC) using STXM and ptychography.
- ◇ Conducted X-ray computed tomography to obtain and analyze 3D microstructural reconstructions of battery and functional materials.
- ◇ Executed quantitative and qualitative elemental analysis and high-resolution elemental mapping using Laser Ablation Laser Ionization Time-of-Flight Mass Spectrometry (LALI-ToF-MS) and close collaboration with development team from EXUM Instruments.
- ◇ Performed quality control, compositional verification, and synthesis optimization using mass spectrometry and thermogravimetric analysis.
- ◇ Characterized structural, morphological, and surface properties using XRD (Rigaku, Siemens, PANalytical Empyrean), SEM, AFM, and XPS, as well as electrical and semiconductor characterization techniques.
- ◇ Interpreted multimodal characterization datasets and generated reproducible analysis workflows using Python, MATLAB, and technique-specific software.
- ◇ Synthesized Li- and Na-based materials (e.g., sodium manganates, ferrites) via co-precipitation and solid-state methods for energy storage, gas capture, and oxidation applications.
- ◇ Developed Python and MATLAB scripts for automated data processing, visualization, and cross-technique correlation.
- ◇ Performed electrochemical characterization using cyclic voltammetry, electrochemical impedance spectroscopy, galvanostatic cycling, and related techniques.
- ◇ Evaluated electrochemical performance, degradation behavior, and stability of synthesized materials for next-generation energy storage applications.

## LANGUAGES

Spanish: Native
English: Fluent

## REFERENCES

- ◇ Johanna Nelson Weker, Ph.D.
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- ◇ Molleigh B. Preefer, Ph.D.
  molleigh@slac.stanford.edu

- Jagjit Nanda, Ph.D.
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  jesse.s.ko88@gmail.com
- Enrique Quiroga González, Ph.D.
  equiroga@ifuap.buap.mx
- Juan David Garay Marín, Ph.D.
  juandavid2756@gmail.com

*Last updated: May 02, 2026*

I, at this moment, declare that all information contained in this curriculum vitae is factually correct and complete.