SANTIAGO D. BARRIONUEVO

PhD Carbon Materials Engineer | CVD, Cleanroom & Advanced Characterization
Graphene & 2D Carbon Materials | Defect/Interface Characterization & Analysis | Python/Data Analysis | From Lab to Fab

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SUMMARY

PhD in Engineering and Electronic Engineer with 8+ years of hands-on research experience in carbon-based materials, including CVD graphene, 2D materials, cleanroom processing, device-oriented integration and advanced structural, spectroscopic and electronic characterization. My direct background is in graphene and related carbon nanomaterials; transferable value for diamond-wafer manufacturing includes carbon CVD, crystallinity/defect analysis, surface/interface characterization, microscopy/spectroscopy, Python data analysis, process troubleshooting and process-to-property interpretation. Based in Zaragoza, with valid work/residence authorization in Spain and immediate availability.

Target fit: Senior Metrology Engineer / Materials Science & Metrology roles requiring advanced characterization, defect detection, topographic/surface analysis, Python data analysis, process feedback, DOE/SPC-aware experimental work and cross-functional R&D/process/production communication.

CORE VALUE FOR CARBON MATERIALS & METROLOGY

- **Carbon-materials foundation:** My daily work has focused on graphene, but the transferable expertise is broader: carbon systems synthesis, crystallinity, defects, surfaces/interfaces and process-to-property analysis are equally relevant for my day to day activities. I work across the whole nanomaterial value chain from CVD growth, interface control, cleanroom processing, device integration, to advanced characterization and data interpretation. This was my main responsibility and role in the EU Project (MELON & ULTIMATE-I).
- **Research-grade metrology:** I have hands-on experience with Raman, SEM, AFM, STM/STS, HRTEM, STEM-HAADF, EELS and XPS to diagnose defects, contamination, interfaces, chemical speciation, crystallinity and reproducibility; established collaboration both at the national and international level and I have access to advanced spectroscopy and electron microscopy facilities in Zaragoza and all over Spain.
- **From Lab to Fab:** I can translate research protocols into process documentation, sample traceability, test matrices, Python analysis scripts and actionable process feedback. My goal is to transfer R&D at the European project level into industrial metrology, process control and quality feedback for carbon-based semiconductor manufacturing.

TECHNICAL SKILLS

Carbon Materials & CVD	CVD graphene; TBLG; graphene quantum dots; carbon quantum dots; graphene foams; vdW heterostructures; GQD/Au/Pt nanohybrids; graphene/YIG stacks; MoS2-related integration; carbon crystallinity/defect awareness.
Process & Cleanroom	CVD growth and equipment operation; wet transfer; substrate chemical attack; cleanroom processing; direct-write photolithography; sputtering; ion milling; Hall-bar/GFET layouts; process troubleshooting; SOP-style documentation.
Characterization / Metrology	Raman; SEM; AFM; HRTEM; STEM-HAADF; EELS; STM/STS; XPS; UV-Vis; FTIR; electrical/electrochemical/optoelectronic measurements; topographic/surface analysis; defect/interface/contamination analysis; quality/failure analysis.
Data / ML / Simulation	Python; MATLAB; C/C++; Flask; HTML/CSS/JavaScript; Git/GitHub; OpenCV; scikit-image; scikit-learn; NumPy; pandas; matplotlib; SQLite; spectral/image analysis; automation scripting; computer-vision prototyping; machine learning fundamentals; neural networks; model evaluation; ORCA; Quantum ESPRESSO; TDDFT/DFT; technical reporting.
Industry Methods	DOE-aware experimental planning; SPC-aware data interpretation; root-cause troubleshooting; process documentation; sample traceability; data integrity awareness; cross-functional collaboration with facilities, PIs, technical staff and external labs.

WORK AND RESEARCH EXPERIENCE

INMA (CSIC/UNIZAR) **Sep. 2024 - Jul. 2026**

Postdoctoral Research Fellow / Early Researcher - Carbon Materials, Device Integration & Advanced Characterization **Zaragoza, Spain**

- **Carbon materials/device integration:** Delivered tasks for ULTIMATE-I and MELON on graphene-based nanomaterials and heterostructures, including MoS2 and YIG stacks, with focus on synthesis, characterization, interface control, device integration and simulation under Dr. Myriam H. Aguirre supervision.
- **Cleanroom/process work:** Worked on 2D material transfer, lithography-based device preparation, sputtering, ion milling and Hall-bar/GFET-oriented workflows; documented process steps, failure modes and reproducibility issues in a process-development style.
- **Advanced facility access:** Secured 3 ELECMI grants in 2025/2026: TEM-EELS on TBLG using NEOARM cFEG TEM at CCiT-UB and two UHV low-temperature JT-STM/STS campaigns at LMA Zaragoza.
- **Advanced characterization and process feedback:** Combined Raman, SEM, AFM, STM/STS, HRTEM, STEM-HAADF, EELS, XPS, UV-Vis and FTIR data to connect structure, defects, contamination, surfaces and interfaces with material quality and device-relevant behavior.
- **Cross-functional execution:** Coordinated sample preparation, proposal writing, measurement planning, post-processing and interpretation with facility staff and collaborators in Spain and Argentina; supervised engineers/students and translated technical results into reports and manuscripts.

Apr. 2018 - Aug. 2024

INIFTA (CONICET-UNLP)

Doctoral Research Fellow - CVD Graphene & Carbon-Derived Nanomaterials **Buenos Aires, Argentina**

- **Carbon CVD platform:** Designed, assembled, maintained and operated custom CVD equipment for graphene growth on Cu foils and Ni foams; used CVD carbon materials as a platform for TBLG, GQDs, CQDs and graphene/metal nanohybrids.
- **Process improvement:** Developed CVD process-control/sensing routines; prior resume record reports approximately 70% shorter synthesis duration through automation and parameter control, giving a strong base for CVD equipment troubleshooting and process optimization.
- **Crystallinity and defect-sensitive carbon structures:** Developed synthesis/transfer protocols to obtain TBLG from CVD graphene on Cu through substrate chemical attack, enabling rotation-angle-dependent electronic structure tuning and structure-property analysis.
- **Device-relevant applications:** Advanced graphene-derived materials for Hg2+/Fe3+ fluorescence sensing, water/wine analysis, photoanodes, dye photodegradation, electrocatalysis, glucose sensing and Au/Pt core-shell nanohybrids.
- **Modeling and data analysis:** Built TDDFT/DFT/Python workflows to simulate GQD absorption/emission, interpret quantum confinement, compare with spectroscopy and guide carbon-material design.

DIAMOND FOUNDRY / SENIOR METROLOGY FIT

- I will bring carbon-materials expertise that can be directly applied to current wafer metrology challenges, including crystallinity, defects, contamination, surface/interface quality, process history and reproducibility.
- I have experience using Raman, SEM, AFM, STM/STS, EELS/TEM, XPS and electron microscopy to diagnose defects, contamination, interfaces, chemical speciation and crystallinity, and can translate this characterization experience into process-relevant and quality-oriented feedback.
- I have developed Python-based workflows for data cleaning, spectral/image analysis, computer-vision prototyping, measurement consistency checks, automated reporting, SQL traceability and defect/interface interpretation.
- I have developed Visual Defect Analyzer 2026 v1.0.0, a Windows-testable Python/Flask metrology application demonstrating calibrated defect detection, visual review, defect manifests, SQLite traceability, wafer-yield scenario projection and engineering reporting. That can be translated directly to Diamond Foundry and even develop a working and sellable product.
- I can translate research protocols into SOP-style documentation, sample traceability, test matrices and data-driven troubleshooting workflows for R&D, process, quality and production-facing environments.
- I have presented results in high profile graphene and carbon related congress. Sharing results between peers and contrasting my research with real feedback both form academy and industry. At Graphene2025, E-MRS 2025, LT30, GEFES 2025 and AMatS 2025, I also produced 10 papers in carbon based nanomaterials. I was a Teaching Assistant in Nanotechnology & Nanomaterials at UNLP and also a professor in several postgrad courses.
- I supervised engineers from bachelor and master thesis directed their final works and contributed both to academic and technical training.

SELECTED PROJECTS, FUNDING & IMPACT

- **ULTIMATE-I H2020 MSCA-RISE (EUR 1.656M):** Working team member/seconded researcher at INMA (CSIC/UNIZAR); graphene-based quantum materials, device integration, advanced sensing systems and carbon-material characterization workflows.
- **MELON H2020 MSCA-RISE (EUR 1.380M):** Seconded researcher at INMA; ultra-clean graphene layers and hybrid Au/Pt-graphene nanostructures for sensing/electrochemical platforms, with process/characterization feedback.
- **ELECMI facility campaigns:** Led proposal drafting and experiment planning for TEM-EELS (NEOARM, CCiT-UB) and low-temperature UHV JT-STM/STS (LMA Zaragoza) applied to TBLG, GQDs and graphene nanoribbons.
- **Research output:** 10 research outputs, including 9 peer-reviewed papers and 1 education-oriented preprint; 3 first-author graphene papers; 101 citations, h-index 7 and i10-index 5 in the Apr. 2026 CVN/Google Scholar record.
- **National funding and awards:** CONICET doctoral fellowship (60 months), CONICET postdoctoral fellowship (up to 36 months), PICT/FONCYT/ANPCyT projects, INNOVAR 2017 and PREMIOS INNOVACION UNLP 2017.

EDUCATION, CERTIFICATIONS & LANGUAGES

- **Doctorate in Engineering, Materials Engineering - Universidad Nacional de La Plata, Argentina | PhD awarded Jul. 2024 | Thesis: TBLG, GQDs and graphene-metal nanohybrids for advanced applications.**
- **Electronic Engineering - Universidad Nacional de La Plata, Argentina | 2017;** Electronic Technician - Technical High School EPT No. 748, Trelew, Argentina | 2011.
- **Professional certifications:** Machine Learning Specialization - **Stanford University** | AI Developer - **IBM** | Data Analytics - **Google**
- **IETLS: B2** professional working proficiency (Spanish native)

TECHNICAL PORTFOLIO FOR DIAMOND FOUNDRY

- **CVD carbon-materials platform:** Cu-foil and Ni-foam CVD graphene growth routes used as precursors for TBLG, GQDs/CQDs and graphene-metal nanohybrids; relevant to carbon CVD, reactor operation, parameter control and process-to-quality learning.
- **Surface/topographic and defect analysis:** AFM/STM topography, SEM/electron microscopy, Raman, EELS and XPS used to identify defects, morphology, chemical speciation, interfaces, edge behavior and reproducibility issues.
- **Python/data/ML readiness:** Python workflows for simulation, spectroscopy interpretation, data cleaning, plotting and technical reporting; ML/data certifications provide foundations for supervised/unsupervised learning, neural networks and model evaluation.
- **Process-to-property interpretation:** Linked growth/transfer history, spectroscopy, microscopy, electrochemistry and simulations to explain optical/electronic behavior, defects and material reliability.
- **Production-facing transition:** Strongest value for Senior Metrology Engineer and process/metrology support roles: advanced characterization, defect/interface analysis, quality/failure analysis, sample traceability and R&D-to-production communication.
- **Device integration exposure:** graphene/YIG stacks, Hall-bar/GFET-oriented layouts, metal deposition, patterning and interface-aware characterization.
- **Immediate practical fit:** based in Zaragoza; valid work/residence authorization in Spain; legalized Engineering degree; available to transition immediately into an on-site industrial role.
- **Computational/data support:** TDDFT/DFT and Python workflows used to link structure, spectroscopy and electronic/optical properties in GQDs/TBLG; useful for metrology interpretation and automated reporting. Developer of the **Visual Defect Analyzer 2026.**