

Prof. Francisco Molina-Lopez
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Department of Materials Engineering, KU Leuven, Belgium (Mar. 2019 – Present)

- **Assistant Professor** in printed functional materials and devices for application on energy, sensing and wearables.
- Active research: **Printed and flexible hybrid inorganic/organic energy harvesting and energy storage devices**: semiconducting nanopowder & polymer processing; ink formulation and rheological characterization; morphological and chemical characterization (SEM, XRD, EDS, ICP-OES, UV-Vis, Raman); electrical and thermal characterization; laser printing, inkjet printing and direct ink writing.
- H2020 **ERC Starting Grant** 2021 awardee.

PROFESSIONAL EXPERIENCE

Hardware Engineering, Apple Inc., USA. (Jan. 2018 – Feb. 2019)

- **Senior Touch Module Process Engineer**: Designing process steps, driving vendors in Asia, collaborating with cross-functional teams.

Department of Chemical Engineering, Stanford University, USA (Apr. 2016 – Jan. 2018)

- **Postdoctoral Researcher** at Bao Research Group.
- Project: **Inkjet-Printed Stretchable Organic and CNTs-Based Transistors for Biomedical Applications and Skin-Like Electronics.**
- Supervisor: **Prof. Zhenan Bao.**
- Acquired competences: Experience in **processing organic electronic materials** (ionic dielectrics, conjugated semiconducting and conducting polymers, sorted and unsorted CNTs) from **solution**; **inkjet printing** of functional materials for **unconventional electronics**; **fabrication and characterization of stretchable and biocompatible field effect transistors.**

Department of Chemical Engineering, Stanford University, USA (Oct. 2014 – Apr. 2016)

- **Swiss National Science Foundation Early PostDoc** research fellow at Bao Research Group.
- Project: **Tuning the Morphology of Solution-Based Organic Semiconductors for Fully-Printed Electronics with Improved Performance.**
- Supervisor: **Prof. Zhenan Bao.**

- Acquired competences: Knowledge in thin-film **preparation and morphological characterization of organic semiconductor materials** by means of **microscopy/spectroscopy** (SEM, AFM, UV-Vis) and **synchrotron x-ray diffraction** methods; fabrication and electrical characterization of **organic FETs** and organic **photovoltaic** cells; theoretical knowledge in **transport phenomena** .
- **Collaboration** in synchrotron X-ray characterization: Michael Toney's group at the **Stanford Synchrotron Radiation Lightsource (SSRL), SLAC (USA)**.

EDUCATION AND TRAINING

Institute of Microengineering (IMT), EPFL, Switzerland (Mar. 2010 – Jun. 2014)

- **PhD** in Microsystems Engineering.
- Dissertation title: **Inkjet-Printed Multisensor Platform on Flexible Substrates for Environmental Monitoring**.
- Supervisors: **Dr. Danick Briand** and **Prof. Nico de Rooij** at the Sensors, Actuators and Microsystems Laboratory (SAMPLAB).
- Funding & Project: FP7-**Marie Curie** Initial Training Network (ITN) **fellow** within the project **FlexSmell** - Gas Sensors on Flexible Substrates for Wireless Applications.
- Acquired competences: Knowledge on **printed, large-area and flexible electronics**; proficiency in **microfabrication** processes by means of both **printing** and **cleanroom**-related methods; proficiency in **design, fabrication** and electrical/mechanical **characterization of MEMS and chemical/physical sensors**; experience in integration of electronics in **smart textiles** acquired throughout the Swiss *Nano-Tera* project *TWIGS*.
- **Main collaborators:** CSEM (Switzerland), ETH Zürich (Switzerland), the Hebrew University of Jerusalem (Israel), Holst Centre (The Netherlands), University of Manchester (UK) and VTT (Finland).

VTT Technical Research Centre of Finland, Finland (Oct. 2011 – Jan. 2012 & Dec. 2012 – Feb. 2013)

- **PhD research visit** under the supervision of **Dr. Maria Smolander** within the frame of the FP7-**Marie Curie** ITN **FlexSmell** project.

University of Granada, Spain (Sep. 2002 – Sep. 2009)

- **Double Major** in **Electrical Engineering (GPA: 8.091 / 10)** and **Physics (GPA: 8.265 / 10)**.
- **Awarded the highest GPA** in Electrical Engineering, class of 2008.

University of California San Diego, USA (Sep. 2008 – Aug. 2009)

- **Undergraduate education abroad (Year GPA: 3.771 / 4)** within the *Education Abroad* program from the University of California.
- Acquired competences: knowledge and training in Nanotechnology and Nanoelectronics; experience in microfabrication within a cleanroom facility.
- **Summer Internship** at the High Speed Devices Group, Department of Electrical Engineering. Supervisor: Prof. Peter Asbeck. Topic: Monte Carlo simulation of carrier transport in graphene following a semi-classical approach.

EPFL, Switzerland (Oct. 2006 – Aug. 2007)

- **Undergraduate education abroad (Year GPA: 5.3 / 6)** within the European *Erasmus* program.
- Acquired competences: Training in analog / digital integrated electronic circuits design; experience with IC design software Cadence.
- **Summer Internship** at the Laboratory of Microsystems and Microelectronics, Institute of Microengineering. Supervisor: Prof. R. S. Popovic. Topic: Measurements, characterization and simulation of a Hall-effect magnetic microsensor using a multi-step spinning current method.

TEACHING AND MENTORING EXPERIENCE

- *Materials Physics and Technology for Nanoelectronics*, **Master of Materials Engineering/Master of Nanoscience, Nanotechnology and Nanoengineering**, KU Leuven (Belgium), fall 2020-22.
- *Nanomaterials for Nanoelectronics*, **Master of Materials Engineering/Master of Nanoscience, Nanotechnology and Nanoengineering**, KU Leuven (Belgium), Spring 2020-22.
- *Surface Science and Engineering* course, **Master of Materials Engineering**, KU Leuven (Belgium), spring 2020-22.
- Supervised and co-supervised 3 bachelor students, 6 master students and 1 1st-year PhD student. **Currently supervising** 1 bachelor student, 3 master students, 9 PhD students and 1 postdoctoral researcher.

GRANTS

- Supported the **Research Foundation-Flanders (FWO) Medium Scale Research Structure** grant *Nanoscale Chemical Analysis Beyond the Diffraction Limit: AFM-IR and s-SNOM* (AKUL/21/013, lead researcher Prof. S. De Feyter, KU Leuven), budget for equipment 816 k€, success rate 32.6 %, **Apr. 2022**.
- Belgium Excellence of Science (**EOS**): *Caloritronics in magnetiC Weyl semimetals (CONENCT)* (ref. 40007563), consortium budget 4 M€ (personal budget 667.7 k€), success rate ~ 20% (based on previous call), **Dec. 2021**.
- **KU Leuven** Internal Funding Interdisciplinary Network (**ID-N**): *Understanding and boosting the performance of organic thermoelectrics by a tailored molecular design guided by experiments and simulations* (ref. IDN/21/012),

budget 700 k€ shared with Prof. G. Koeckelberghs & Prof. D. Escudero (Dept. Chemistry, KU Leuven), success rate 47 %, **Oct. 2021**.

- **KU Leuven** Internal Funding **C1: Towards additive manufacturing of flexible thermoelectric energy harvesters: boosting the performance by laser sintering-induced nanostructuring** (ref. C14/21/078), budget 390 k€, success rate 45%, **Sept. 2021**.
- Research Foundation-Flanders (**FWO**) **Junior Research Project: Printed organic photovoltaics for energy harvesting in smart contact lenses** (ref. G065021N), budget 409.8 k€, success rate 21.4 %, **Dec. 2020**.
- European Union **H2020 ERC-2020-STG 3DALIGN: Enhancing the performance of 3D-printed organic thermoelectrics by electric field-assisted molecular alignment** (ref. 948922), budget 1.711 M€, success rate 13 %, **Sept. 2020**.
- Supported the **KU Leuven Small Research Infrastructure** grant (lead researcher Prof. B. Van Hooreweder, KU Leuven), budget for a laser 3D printer PrintGenius150 AM, success rate 41.3 %, **Dec. 2020**.
- Supported the **Research Foundation-Flanders (FWO) Medium Scale Research Structure** grant **COMPLEXURF: Laboratory of complex surfaces and interfaces** (lead researcher Prof. D. Seveno, KU Leuven), budget for equipment 584 k€, success rate 29.2 %, **Jan. 2020**.

MEMBERSHIPS

- Leuven Brain Institute (LBI); KU Leuven Institute for Micro- and Nanoscale Integration (LIMNI); KU Leuven Additive Manufacturing Institute

ACADEMIC HONORS AND AWARDS

- Awarded the **Swiss National Science Foundation Early PostDoc Mobility Fellowship**, *Fully-printed organic electronics and sensors on flexible substrates for wearable point-of-care applications*. Budget to cover living and travel expenses as a postdoctoral researcher at Stanford University from **Oct. 2014 to Mar. 2016**.
- Awarded for obtaining the **highest GPA** (8.091 out of 10) in the major of **Electrical Engineering** at the **University of Granada** (Spain) in 2008.
- Elected by the University of California to participate in its *Education Abroad Program*.
- Honors in Final Degree Project (Semester Project at EPFL).

EDITORIAL ACTIVITY

- **Reviewer** of the international journals: *Micromachines* (MDPI), *Sensors and Actuators A: Physical* (Elsevier), *Sensors and Actuators B: Chemical* (Elsevier), *Flexible and Printed Electronics* (IOPscience), **Small** (Wiley),

Communications Materials (Nature Research), *Nature Communications* (Nature Research), and *Advanced Materials* (Wiley).

- **Editor** for the journal *Sensors* (MDPI), board member for the section *Electronic Sensors*.
- **Associate editor** *Frontiers in Electronics*, specialty *Flexible Electronics*.

PROJECT REVIEW EXPERIENCE

- Member of the **panel W&T6: Chemical Engineering, Material Sciences, Research Foundation-Flanders (FWO)**, Belgium, 2022-2024.
- Reviewer **ANR** (Agence Nationale de la Recherche), France, 2021.

SELECTED PUBLICATIONS (*h* index = 25, complete list in <https://scholar.google.com/citations?user=YaAZ2PIAAAAJ&hl=en>)

1. Y. Tian and **F. Molina-Lopez**, *Boosting the performance of printed thermoelectric materials by inducing morphological anisotropy*, **Nanoscale** (2021), vol. 13, 5202. DOI: 10.1039/D0NR08144B.
2. J. Liu, J. Wang, Z. Zhang, **F. Molina-Lopez**, G.-J. N. Wang, B.C. Schroeder, X. Yan, Y. Zeng, O. Zhao, H. Tran, T. Lei, Y. Lu, Y.-X. Wang, J. B.-H. Tok, R. Dauskardt, J. W. Chung, Y. Yun and Z. Bao, *Fully Stretchable Active-Matrix Organic Light-Emitting Electrochemical Cell Array*, **Nature Communications** (2020), vol. 11, 3362. DOI: 10.1038/s41467-020-17084-w.
3. U. Kraft, **F. Molina-Lopez**, D. Son, Z. Bao and B. Murmann, *Ink Development and Printing of Conducting Polymers for Intrinsically Stretchable Interconnects and Circuits*, **Advanced Electronic Materials** (2019), vol. 6, pp. 1900681. DOI: 10.1002/aelm.201900681.
4. **F. Molina-Lopez**, T. Z. Gao, U. Kraft, C. Zhu, T. Öhlund, R. Pfattner, V. R. Feig, Y. Kim, S. Wang, Y. Yun and Z. Bao, *Inkjet-Printed Stretchable and Low Voltage Synaptic Transistor Array*, **Nature Communications** (2019), vol. 10, 2676. DOI: 10.1038/s41467-019-10569-3.
5. G. Chen, R. Rastak, Y. Wang, H. Yan, V. Feig, Y. Liu, Y. Jiang, S. Chen, F. Lian, **F. Molina-Lopez**, L. Jin, K. Cui, J.W. Chung, E. Pop, C. Linder and Zhenan Bao, *Strain- and Strain-Rate-Invariant Conductance in a Stretchable and Compressible 3D Conducting Polymer Foam*, **Matter** (2019), vol. 1, pp. 1-14. DOI: 10.1016/j.matt.2019.03.011.
6. J. Xu, H.-C. Wu, C. Zhu, A. Ehrlich, L. Shaw, M. Nikolka, S. Wang, **F. Molina-Lopez**, X. Gu, S. Luo, D. Zhou, Y.-H. Kim, G.-J.N. Wang, K. Gu, V.R. Feig, S. Chen, Y. Kim, T. Katsumata, Y.-Q. Zheng, H. Yan, J.W. Chung, J. Lopez, B. Murmann and Z. Bao, *Multi-Scale Ordering in Highly Stretchable Polymer Semiconducting Films*, **Nature Materials** (2019), vol. 18, pp. 594-601. DOI: 10.1038/s41563-019-0340-5.

7. A. Gasperini, G.-J.N. Wang, **F. Molina-Lopez**, H.-C. Wu, J. Lopez, J. Xu, S. Luo, D. Zhou, G. Xue, J.B.-H. Tok and Z. Bao, *Characterization of Hydrogen Bonding Formation and Breaking in Semiconducting Polymers under Mechanical Strain*, **Macromolecules** (2019), vol. 52 (6), pp. 2476-2486. DOI: 10.1021/acs.macromol.9b00145.
8. D. Son, J. Kang, O. Vardoulis, Y. Kim, N. Matsuhisa, J.Y. Oh, J.W.F. To, J. Mun, T. Katsumata, Y. Liu, A.F. McGuire, M. Krason, **F. Molina-Lopez**, J. Ham, U. Kraft, Y. Lee, Y. Yun, J.B.-H. Tok and Z. Bao, *An integrated self-healable electronic skin system fabricated via dynamic reconstruction of a nanostructured conducting network*, **Nature Nanotechnology** (2018), vol. 13 (11), pp. 1057-1065.
9. T.Z. Gao, T. Lei, **F. Molina-Lopez** and Z. Bao, *Enhanced Process Integration and Device Performance of Carbon Nanotubes via Flocculation*, **Small Methods** (2018), vol. 2 (10), pp. 1800189.
10. G.-J.N. Wang, **F. Molina-Lopez**, H. Zhang, J. Xu, H.-C. Wu, J. Lopez, L. Shaw, J. Mun, Q. Zhang, S. Wang, A. Ehrlich and Z. Bao, *Nonhalogenated Solvent Processable and Printable High-Performance Polymer Semiconductor Enabled by Isomeric Nonconjugated Flexible Linkers*, **Macromolecules** (2018), vol. 51 (13), pp. 4976-4985.
11. **F. Molina-Lopez**, H.-C. Wu, G.-J. N. Wang, H. Yan, L. Shaw, J. Xu, M.F. Toney and Z. Bao, *Enhancing Molecular Alignment and Charge Transport of Solution-Sheared Semiconducting Polymer Films by the Electrical - Blade Effect*, **Advanced Electronic Materials** (2018), vol. 4, pp. 1800110.
12. S. Wang, J. Xu, W. Wang, G.-J.N. Wang, R. Rastak, **F. Molina-Lopez**, J.W. Chung, S. Niu, V.R. Feig, J. Lopez, T. Lei, S.-K. Kwon, Y. Kim, A.M. Foudeh, A. Ehrlich, A. Gasperini, Y. Yun, B. Murmann, J.B.-H. Tok and Z. Bao, *Skin electronics from scalable fabrication of an intrinsically stretchable transistor array*, **Nature** (2018), vol. 555 (7694), pp. 83-88.
13. X. Gu, Y. Zhou, K. Gu, T. Kurosawa, Y. Guo, Y. Li, H. Lin, B.C. Schroeder, H. Yan, **F. Molina-Lopez**, C.J. Tassone, C. Wang, S.C.B. Mannsfeld, H. Yan, D. Zhao, M.F. Toney and Z. Bao, *Roll-to-Roll Printed Large Area All-Polymer Solar Cells with 5% Efficiency Based on a Low Crystallinity Conjugated Polymer Blend*, **Advanced Energy Materials** (2017), vol. 7 (14), pp. 1602742.
14. Y. Wang, C. Zhu, R. Pfattner, H. Yan, L. Jin, S. Chen, **F. Molina-Lopez**, F. Lissel, J. Liu, N.I. Rabiah, Z. Chen, J.W. Chung, C. Linder, M.F. Toney, B. Murmann and Z. Bao, *A Highly Stretchable, Transparent and Conductive Polymer*, **Science Advances** (2017), vol. 3 (3), pp. e1602076.
15. **F. Molina-Lopez**, H. Yan, X. Gu, Y. Kim, M.F. Toney, Z. Bao, *Electric Field Tuning Molecular Packing and Electrical Properties of Solution-Shearing Coated Organic Semiconducting Thin Films*, **Advanced Functional Materials** (2017), vol. 27 (8), pp. 1605503.
16. X. Gu, H. Yan, T. Kurosawa, B.C. Schroeder, K.L. Gu, Y. Zhou, J.W.F. To, S.D. Oosterhout, V. Savikhin, **F. Molina-Lopez**, C.J. Tassone, S.C.B. Mannsfeld, C. Wang, M.F. Toney, Z. Bao, *Comparison of the Morphology Development of Polymer-Fullerene and Polymer-Polymer Solar Cells during Solution - Shearing Blade Coating*, **Advanced Energy Materials** (2016), vol. 6 (22), pp. 1601225.

17. A. Vásquez Quintero, **F. Molina-Lopez**, E.C.P. Smits, E. Danesh, J. van den Brand, K. Persaud, A. Oprea, N. Barsan, U. Weimar, N.F. de Rooij, D. Briand, *RFID Label with Printed Multisensor Platform for the Monitoring of Perishable Goods*, **Flexible and Printed Electronics** (2016), vol. 1 (2), pp. 025003.
18. **F. Molina-Lopez**, D. Briand, N.F. de Rooij, *Inkjet and Microcontact Printing of Functional Materials on Foil for the Fabrication of Pixel-Like Capacitive Vapor Microsensors*, **Organic Electronics** (2015), vol. 16, pp. 136-147.
19. **F. Molina-Lopez**, R.E. De Araujo, M. Jarrier, J. Courbat, D. Briand and N.F. de Rooij, *Study of Bending Reliability and Electrical Properties of Platinum Lines on Flexible Polyimide Substrates*, **Microelectronics Reliability**, vol. 54 (11), pp. 2542-2549.
20. E. Danesh, **F. Molina-Lopez**, M. Camara, A. Bontempi, A. Vásquez Quintero, D. Teyssieux, L. Thiery, D. Briand, N.F. de Rooij, K.C. Persaud, *Development of a New Generation of Ammonia Sensors on Printed Polymeric Hotplates*, **Analytical Chemistry** (2014), vol. 86 (18), pp. 8951-8958.
21. J.F. Salmerón, **F. Molina-Lopez**, D. Briand, J.J. Ruan, A. Rivadeneyra, M.A. Carvajal, L.F. Capitan-Vallvey, N.F. de Rooij and A.J. Palma, *Properties and Printability of Inkjet and Screen-Printed Silver Patterns for RFID Antennas*, **Journal of Electronic Materials** (2014), vol. 86 (18), pp. 604-617.
22. **F. Molina-Lopez**, D. Briand and N.F. De Rooij, *Decreasing the Size of Printed Comb Electrodes by the Introduction of a Dielectric Interlayer for Capacitive Gas Sensors on Polymeric Foil: Modeling and Fabrication*, **Sensors and Actuators B: Chemical** (2013), vol. 189, pp. 89-96.
23. **F. Molina-Lopez**, T. Kinkeldei, G. Tröster, D. Briand, N.F. de Rooij, *Theoretical and Experimental Study of the Bending Influence on the Capacitance of Interdigitated Micro-Electrodes Patterned on Flexible Substrates*, **Journal of Applied Physics** (2013), vol. 114, pp. 174907.
24. G. Mattana, T. Kinkeldei, D. Leuenberger, C. Ataman, J.J. Ruan, **F. Molina-Lopez**, A. Vásquez Quintero, G. Nisato, G. Tröster, D. Briand and N.F. de Rooij, *Woven Temperature and Humidity Sensors on Flexible Plastic Substrates for E-Textile Applications*, **IEEE Sensors Journal** (2013), vol. 13 (10), pp. 3901-3909.
25. **F. Molina-Lopez**, A. Vásquez Quintero, G. Mattana, D. Briand, N.F. de Rooij, *Large-Area Compatible Fabrication and Encapsulation of Inkjet-Printed Humidity Sensors on Flexible Foils with Integrated Thermal Compensation*, **Journal of Micromechanics and Microengineering** (2013), vol. 23, pp. 025012.
26. **F. Molina-Lopez**, D. Briand and N.F. de Rooij, *All Additive Inkjet Printed Humidity Sensors on Flexible Substrate*, **Sensors and Actuators B: Chemical** (2012), vol. 166-167, pp. 212-222.

INVITED PRESENTATIONS

1. **F. Molina-Lopez**, *Emerging Thermoelectric Generators Based on Printed and Flexible Electronics Technology*, In Proceedings of the 19th IEEE Sensors Conference, **IEEE SENSORS 2020**, Virtual Conference, 25-28 October 2020.

PARTICIPATION IN DOCTORAL COMMITTEES

1. Francisco J. Romero (PhD candidate), *Design, Modeling and Fabrication of Flexible Sensors for IoE Applications using Emerging Technologies*, **University of Granada** (Spain), supervisors Prof. D. P. Morales Santos and Prof. N. Rodriguez, **Jul. 2021**.
2. Fernando Moreno Cruz (PhD candidate), *Wireless power for IoT*, **University of Granada** (Spain), supervisors Prof. D. P. Morales Santos and Dr. A. Rivadeneyra, **Dec. 2020**.
3. Cecilia Teixeira da Rocha (PhD candidate), *Improved Organic Semiconductor Thin-Film Formation through the Addition of Vibrations to the Solution Shearing Method*, **Dresden University of Technology** (Germany), supervisor Prof. S. Mannsfeld, **Jun. 2020**.

OTHER PERSONAL SKILLS

- Ability to adapt to **multicultural situations** acquired through working and living in many countries: Spain, Switzerland, Finland, USA and Belgium.
- Languages: **Spanish** (Native), **English** (Fluent), **French** (Fluent), **Dutch** (Intermediate, B1), **Mandarin** (Beginner).
- Extracurricular activities: I have studied classical music for ten years, obtaining the certificate for intermediate level in piano from the Superior Conservatory of Music Victoria Eugenia of Granada (Spain).