

# Damien Voiry

Ph.D.

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## Education

- **PhD, Centre de Recherche Paul Pascal (CRPP-CNRS), University of Bordeaux , France – Nov. 2010**

**Title:** Solubilization and covalent functionalization of carbon nanotubes and other nano-forms of carbon

Supervisor: Alain Pénicaud, Research Director, CNRS, CRPP, University of Bordeaux

Co-supervisor: Oliver Roubeau, Research Associate, Instituto de Ciencias de Materiales de Aragón-CSIC, Universidad de Zaragoza, Zaragoza, Spain

- **M.Sc. in chemistry and physics, University of Bordeaux, France – Sept. 2007**

National School of Chemistry and Physics (ENSCBP), specialization in Micro and Nanotechnology

- **B.Sc. in Physics and Chemistry, Lycée Descartes, University of Tours, France – Jul. 2004**

## Research Background

- **CNRS staff scientist, European Institute of Membrane, Montpellier, France – Feb. 2016 - Present**

Synthesis and study of novel 2D materials for energy related applications and novel membranes

- **Researcher, Materials Science and Engineering, Rutgers University, NJ, USA – Jan. 2011 - Jan. 2016**

Postdoctoral study: Synthesis and modifications of 2D nanomaterials (transition metal dichalcogenides, graphene, graphene oxide), investigation about the relation between structure and properties for energy conversion, energy storage and opto-electronics

Advisor: Prof. Manish Chhowalla, Rutgers University

- **Visitor at Prof. Eda's lab (National University of Singapore, Singapore) and Prof. Shin (Ulsan National Institute of Science and Technology, Korea) – Jan - Feb 2015**

- **PhD student, CNRS, Centre Recherche Paul Pascal, France – Nov. 2007 - Nov. 2010**

Doctoral study: Solubilization of carbon nanotubes, controlled covalent functionalization of carbon nanotubes and carbon nanohorns

- **Paid internship, Arkema Inc., Pau, France – May - Sept. 2007**

Vapor phase functionalization of multi-walled carbon nanotubes with silicon

- **Paid internship, Hitachi Chemical Co. Ltd., Hitachi City, Japan – Jul. - Dec. 2006**

Fuel cell fabrication and characterization of polymer membranes for Direct Methanol Fuel Cell

## Awards

IAAM Scientist Medal – 2021

Nomination at the Young Academic of Europe – 2020

CNRS Bronze Medal Award – 2020

ERC Starting Grant 2018 (#804320\_ 2D-4-CO<sub>2</sub>) "Designing 2D Nanosheets for CO<sub>2</sub> Reduction and Integration into vdW Heterostructures for Artificial Photosynthesis" – 2018

Highly Cited Research (Clarivate Web of Science)	— 2018
CNRS Excellent research award (PEDR)	— 2016
JSPS PhD Fellowship	— 2009

## Commissions of trust

Member the Advisory panel of DERBI, France

Member of the FWO Review College, Belgium

Reviewer for the ERC, Flagship ERA-NET, Czech Science Foundation; Edge Fellow Program of Ireland, National Science Center of Poland, Israel Science Foundation, DFG

Reviewer for international journals including Science, Nature Materials, Nature Nanotechnology, Nature Catalysis, Nature Energy, JACS, ACS Nano, Adv. Energy Materials

## Fellowships and external grants

Co-PI on PEPR Carbon-free Hydrogen “Robust and Autonomous Photoelectrochemical cells with III-V thin films on Si for practical hydrogen production (NAUTILUS)” (€180K) — 2022

Co-PI on ITN - Horizon 2020 “Electrochemical Conversion of CO<sub>2</sub> into Added Value Products via Highly Selective Bimetallic Materials and Innovative Process Design (ECOMATES)” (€230K) — 2022

PI on ERC Proof of Concept Grant 2021 (2D-MEMBA) “Membrane Electrode Assembly for High Pressure Electrochemical Conversion of CO<sub>2</sub> to Ethylene: HIPECO<sub>2</sub>” (€150K) — 2022

PI on SATT-AxLR transfer project “Industrialization of the electrochemical conversion reaction CO<sub>2</sub>-to-ethylene” (€260K) — 2021

PI on ANR-PRC 2021 (2D-MEMBA) “Nanofluidic Ionic Diodes Hybrid Membranes For Desalination and Water Purification ” (€485K) — 2021

Partner on “Novel 2D Materials: Transition Metal Dichalcogenides” (Research and Society Project, Occitanie Region) ((€1,094K/€54K) — 2018

PI on ERC Starting Grant 2018 (#804320\_ 2D-4-CO<sub>2</sub>) “Designing 2D Nanosheets for CO<sub>2</sub> Reduction and Integration into vdW Heterostructures for Artificial Photosynthesis” (€1,500K) — 2018

PI on CNRS PEPS: “Osmotic energy from two- dimensional nanosheets” (€15K) — 2016-2017

PI on CNRS PEPS: “CO<sub>2</sub> reduction from 2D materials” (€15K) — 2017-2018

PI on US Army Grant: “Electrochemical degradation of chemical warfare agents and explosives using exfoliated 2D materials” (\$48K) — 2017-2018

PI on IEM internal grant: “Interaction amyloid proteins with Two-dimensional materials for bio-inspired nanofluidics” (20 k€) — 2017-2018

## Teaching

Lab class on carbon nanotubes at undergraduate level (senior) — 2009 - 2010

Research projects for undergraduate students — 2011 - 2015

Metal evaporation laboratory experiments for undergraduate students — 2012 - 2014

New-Jersey Governor’s School of Engineering & Technology: The Hydrogen Economy — 2013 - 2015

2D Nanomaterials for Energy (lecture for Master students) — 2017 - present

Hydrogen and fuel cells: Towards the H<sub>2</sub> economy (master students) — 2022 - present

## Key Figures

Number of publications in peer-reviewed journals: 55

h-index: 36, Total number of citations: > 16,000 (based on Web of Science)

Including 11 articles published in Nature journals (3 as first author, 3 corresponding author), 1 Science (first

author)

Numbers of patents: 4 (+ 5 under evaluation), 1 licensed by Ever Power Holding, China

Number of invited oral contributions to international conferences: 20 (including 3 Keynotes)

## Research Activity

### • Selected publications

10. H. Wu, J. Li, K. Qi, Y. Zhang, E. Petit, W. Wang, V. Flaud, N. Onofrio, B. Rebiere, L. Huang, C. Salameh, L. Lajaunie, P. Miele & D. Voiry, Improved electrochemical conversion of CO<sub>2</sub> to multicarbon products by using molecular doping. *Nature Communications*, 2021, *Accepted*
9. Ries, L.; Petit, E.; Michel, T.; Diogo, C. .C.; Gervais, C.; Salameh, C.; Bechelany, M.; Balme, S.; Miele, P.; Onofrio, N.; Voiry, D.\* Enhanced sieving from exfoliated MoS<sub>2</sub> membranes via covalent functionalization, *Nature Materials*, 2019 18, 1112–1117
8. Yang, J.; Mohmad, A. R.; Wang, Y.; Fullon, R.; Song, X.; Zhao, F.; Bozkurt, I.; Augustin, M.; Santos, E. J. ; Shin, H. S.; Zhang, W.; Voiry, D.; Jeong, H. Y.; Chhowalla, M. Ultrahigh-current-density niobium disulfide catalysts for hydrogen evolution, *Nature Materials*, 2019, 1309–1314
7. Li, L.; Qin, Z.; Ries, L.; Hong, S.; Michel, T.; Yang, J.; Salameh, C.; Bechelany, M.; Miele, P.; Kaplan, D.; Chhowalla, M; Voiry, D.\* Role of Sulfur Vacancies and Undercoordinated Mo Regions in MoS<sub>2</sub> Nanosheets Towards the Evolution of Hydrogen, *ACS Nano*, 2019, 13, 6, 6824-6834
6. Voiry, D.\*; Shin, H. S.; Loh, K. P. & Chhowalla, M. Low-dimensional catalysts for hydrogen evolution and CO<sub>2</sub> reduction, *Nature Reviews Chemistry*, 2018, 2, 0105
5. Voiry, D.; Yang, J.; Kupferberg, J.; Fullon, R.; Lee, C.; Jeong, H.Y.; Shin, H.S. & Chhowalla, M. High-quality graphene via microwave reduction of solution-exfoliated graphene oxide, *Science*, 2016, 353, 1413-1416 (Featured in [nanotechweb.org](http://nanotechweb.org), [phys.org](http://phys.org), [worldeconomicforum.org](http://worldeconomicforum.org))
4. Voiry, D.; Fullon, R.; Yang, J.; Carvalho Silva, C.; Koppera, R.; Bozkurt, I.; Kaplan, D.; Lagos, M. J.; Batson, P. E.; Gupta, G.; Mohite, A. D.; Dong, L.; Er, D.; Shenoy, V. B.; Asefa, T. & Chhowalla, M. The Role of Electronic Coupling between Substrate and 2D MoS<sub>2</sub> Nanosheets on Electro-Catalytic Production of Hydrogen, *Nature Materials*, 2016, 15, 1003–1009
3. Acerce, M.; Voiry, D.; Chhowalla, M. Metallic 1T phase MoS<sub>2</sub> nanosheets as supercapacitor electrode materials, *Nature Nanotechnology*, 2015, 10, 313 (Featured in [nanotechweb.org](http://nanotechweb.org))
2. Voiry, D.; Goswami, A.; Koppera, R.; Carvalho Silva, C.; Kaplan, D.; Fujita, T.; Chen, M.; Asefa, T. & Chhowalla, M. Covalent functionalization of monolayered transition metal dichalcogenides by phase engineering, *Nature Chemistry*, 2015, 7, 45
1. Voiry, D.; Yamaguchi, H.; Li, J.; Silva, R.; Alves, D.; Fujita, T.; Chen, M.; Asefa, T.; Shenoy, V.; Eda, G. & Chhowalla, M. Enhanced catalytic activity in strained chemically exfoliated WS<sub>2</sub> for hydrogen evolution, *Nature Materials*, 2013, 12, 850 (Featured in [nanotechweb.org](http://nanotechweb.org))

### • Patents

8. Electrocatalytic conversion of CO<sub>2</sub> in C<sub>2</sub>+ products (isopropanol, ethanol and ethylene) using Air or CO<sub>2</sub> over-saturated electrolyte, Deposited Jan. 22
7. Electrocatalytic Material Comprising Nitrogen-Rich Carbon Nanosheets With Inclusions Of Metal Atoms And Use Thereof, , Deposited Nov. 2020

6. Functionalized AgCu Dendrite Catalysts For Electrochemical Conversion Of Co<sub>2</sub> To Small Molecules, Deposited Nov. 2020
5. Aqueous Drilling Fluid Composition Comprising Xanthan Gum And Vermiculite, Deposited July 2020
4. Javanmard, M.; Gholizadeh, A.; Chhowalla, M.; Laumbach, R. J.; Kipen, H. M.; Weisel, C. P.; Gow, A. J.; Voiry, D. Quantification Of Inflammatory Molecules In Exhaled Breath Condensate Using Differential Pulse Voltammetry On Reduced Graphene Oxide Sensor, US Patent App. 15/997,598, 2018
3. Voiry, D.; Pagona, G.; Pénicaud, A. & Tagmatarchis, N., Solutions of carbon nanohorns, method for making same and uses thereof, WO/2011/154894
2. Bordere, S.; Cochard, D.; Duthil E.; Gaillard, P. & Voiry, D. for Arkema Inc., Method and system for depositing metal or metalloid on carbon nanotubes, WO/2009/112738
1. Voiry, D.; Yang, J.; Kupferberg, J & Chhowalla, M. Title: High-quality graphene via microwave reduction of solution-exfoliated graphene oxide, Deposited with Rutgers University (Licensed by Everpower Holding Co. Ltd.)

• **Invited talks/Keynotes:**

23. Voiry, D. Exfoliated MoS<sub>2</sub> nanosheets for water treatment, Graphene Week 2022, Munich, Germany, Sept. 2022
22. Voiry, D. Molecular doping of metal catalysts for improving the electrochemical conversion of CO<sub>2</sub> to multicarbon products, Junior Euromat 2022, Coimbra, Portugal, July 2022 (Invited Keynote)
21. Voiry, D. Electrosynthesis from exfoliated two-dimensional transition metal dichalcogenides, MDPI Webinar, Sept. 2021 (Invited Webinar)
20. Voiry, D. Heterostructures of 2D materials: Synthesis and applications in energy (Invited Keynote), GDR-HowDi, March 2021 (Virtual conference)
19. Voiry, D. Electrocatalysis from two-dimensional materials: an ERC project, American Physics Society – APS March Meeting, Denver, USA, March 2-6, 2021 (canceled because of COVID-19)
18. Voiry, D. 2D Transition Metal Dichalcogenides for Environmental applications, 2021 International Forum on Graphene, Shenzhen, April . 2021 (Invited Keynote)
17. Voiry, D. Optimizing the electrocatalytic CO<sub>2</sub>-to-CO conversion from 2D silver nanoplates via superstructure assembly, Nanoinnovation, Rome, Italy, Sept. 2020 (Virtual conference)
16. Voiry, D. Covalently Functionalized 2D Transition Metal Dichalcogenides for Molecular Sieving, American Vacuum Society, Oct . 2020 (canceled because of COVID-19)
15. Voiry, D. Covalently Functionalized 2D Transition Metal Dichalcogenides for Molecular Sieving, European Materials Research Society Conference E-MRS, Strasbourg, France, May 25-29, 2020 (canceled because of COVID-19)
14. Voiry, D. Exfoliated 2D TMDs: Preparation, Modifications and Uses, Flatland 2019, France, 2019
13. Voiry, D. Structural engineering of exfoliated 2D materials, LDMO Conference, Shenzhen, China, 2018

12. **Voiry, D.** Defect engineering and Functionalization of 2D TMDs for Electrocatalysis and Molecular Sieving TNT Conference, Lecce, Italy, 2018
11. **Voiry, D.** Optoelectronics from Chemically Modified Transition Metal Dichalcogenides, ATOMOPTO Conference, Warsaw, Poland, 2018
10. **Voiry, D.** 2D Materials: Exfoliation, Synthesis and application in Energy, NYYS Conference, Yachay Tech. Univ. Ecuador, 2018
9. **Voiry, D.** Exfoliation techniques of two-dimensional materials, Frontier Research In 2D Materials, Cargèse, France, 2018
8. **Voiry, D.** Energy conversion from chemically exfoliated 2D materials, Chem2DMat, Strasbourg, France, 2017
7. **Voiry, D.** Tuning the properties of transition metal dichalcogenides via phase engineering, GDR-I GNT, Strasbourg, France, Sept. 2014
6. **Voiry, D.** Chemically exfoliated transition metal dichalcogenides and applications, ChemOnTubes 2014, Riva Del Garda, Italy, 2014
5. **Voiry, D.** & Chhowalla, M. Chemically exfoliated transition metal chalcogenides as hydrogen evolution catalysts, 246<sup>th</sup> ACS conference, Indianapolis, USA, 2013
4. **Voiry, D.** Enhanced Catalytic Activity in Strained Chemically Exfoliated WS<sub>2</sub> Nanosheets for Hydrogen Evolution, Los Alamos Nation Laboratory, New-Mexico, USA, 2013
3. **Voiry, D.** & Chhowalla, M. Decorated graphene oxide for catalysis and bio-applications, Graphene Week, Chemnitz, Germany, 2013
2. **Voiry, D.** & Pénicaud, A., Chemical modification of graphene through functionalization, Discussion Lavoisier, Dourdan, France, 2013
1. **Voiry, D.**; Chhowalla, M., Solution Processable Two Dimensional Materials for Energy Applications, 59<sup>th</sup> American Vacuum Society Conference 2012, Tampa (Florida), USA, 2012