

# Dr Meganne Christian, PhD

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*Languages: English (native), Italian (fluent), French (conversational)*

*h-index: 13*

## Current position

**Jun 2016 – Nov 2018 and Feb 2020 – Present**

*Research fellow at CNR-IMM (Bologna, Italy) under the projects “Production and characterization of nanostructured planar and 3D materials based on graphene” and “THINC: Thin-film solar cell based on nanocrystalline silicon and structured backside reflectors”. Extensive participation in work packages 13 and 14 of the European project, the “Graphene Flagship”.*

Research activities include:

- Synthesis, processing and functionalisation of 2D and 3D graphene and related materials by Chemical Vapour Deposition on a variety of substrates in a cleanroom environment
- Integration of graphene and related materials in applications such as solar cells, batteries, sensors and fuel cells. Development of graphene coatings to improve the properties of loop heat pipes and testing in microgravity conditions during parabolic flight
- Analysis of graphene and graphene nanocomposites using Scanning Electron Microscopy (SEM) and Scanning Transmission Electron Microscopy (STEM) in the SEM

Co-supervision experience:

- Masters student (Federico Giuliano, “Membrane di grafene porose tridimensionali: crescita mediante CVD e proprietà elettromeccaniche” Tesi di Laurea Magistrale in Fisica, University of Bologna Mar 31 2017)
- Undergraduate student (Valentina Consolaro Girelli, “Misure di evaporazione attraverso materiali porosi a base di grafene” Tesi di Laurea Triennale in Fisica, University of Bologna Mar 16 2018)

Selected media: <https://www.youtube.com/watch?v=LKGiDoxIqzw>

## Previous research experience

**Nov 2018 – Dec 2019**

*Atmospheric physicist/meteorologist (Concordia Station, Antarctica) for CNR-ISAC under assignment to PNRA*

Winter-over researcher responsible for the projects:

- BSRN (Baseline Surface Radiation Network), management of the downwelling and upwelling radiometers, sun photometer and ground and sky cameras to study the surface fluxes of solar and thermal radiation
- Routine Meteorological Observatory, management of weather stations and daily radiosoundings
- Stratospheric Lidar, management of observatory for the investigation of the optical properties of Polar Stratospheric clouds by periodic lidar measurements
- LTCPAA (Long term measurements of chemical and physical properties of atmospheric aerosol at Dome C, shared responsibility with glaciologist), management of instruments for measuring atmospheric aerosol

- FIRCLOUDS (Far Infrared Radiative closure experiment for Antarctic Clouds, shared responsibility with electroscience coordinator), management of a radar, ice-camera and tropospheric lidar to study ice and mixed phase clouds over the Antarctic plateau

Extensive involvement in scientific divulgation through 70+ videoconferences with schools, conferences, journalists and public events.

Selected media: Il Messaggero <https://bit.ly/2MfF1ar> (Italian)

Technical documents:

- Weekly reports (prot. n. DC 2018-2019/132, 134-145, 147-150, 153-158, 160, 162-165, 169, 173)
- Final report Winterover 2019 – DC15 Atmospheric Physics and Meteorology (prot. n. DC 2018-2019/172)

### **Jun 2014 – Jun 2016**

*Post-doctoral research grant at CNR-ISOF (working in IMM laboratories, Bologna, Italy) under the project “Graphene based revolutions in ICT and beyond”, Work Package 10 (Nanocomposites) of the European Graphene Flagship.*

Research theme: “Production and microscopical characterization of graphene-based polymer nanocomposites”

Co-supervision experience:

- Undergraduate student (Chiara Labanti, “Proprietà di conduzione elettrica in campioni di grafene poroso” Tesi di Laurea Triennale in Fisica, University of Bologna Jul 15 2016)
- Masters student (Linda Venturi, “Deposizione di grafene su superfici porose 3D col metodo CVD” Tesi di Laurea Magistrale in Fisica, University of Bologna Apr 1 2016)

Media: <http://bit.ly/1UgdQNw> (Italian)

### **Feb 2010 – Feb 2014**

*PhD in Industrial Chemistry, UNSW School of Chemical Engineering, MERLin Group (Sydney, Australia). Included 6-week research visit to Empa (Swiss Federal Laboratories for Materials Science and Technology) in the Hydrogen and Energy Laboratory (May-June 2013).*

Research theme: design, synthesis and advanced characterisation of nanomaterials for hydrogen storage applications

Thesis title: “Core-shell borohydrides for reversible hydrogen storage”, conferred Feb 19 2014

Supervisor: Kondo-François Aguey-Zinsou

Selected Media:

- Youtube “Endless Energy” <http://www.youtube.com/watch?v=A6TOGiv6pi8>
- Australian Broadcasting Corporation: Science <http://www.abc.net.au/science/articles/2012/08/16/3569478.htm>

Awards:

- UNSW Faculty of Engineering “Dean’s Award for Excellence in Postgraduate Research” (2013)
- Australian Institute of Energy “National Postgraduate Student Energy Award: Energy in Society” (2012)
- UNSW Faculty of Engineering “Faculty of Engineering Student Service Award” (2012)
- Arc@UNSW “Heinz Harant Award for volunteer contributions made to student life at UNSW” (2012)
- The University of New South Wales “UNSW Research Excellence Award” (2010)

## Education

2009 **Bachelor of Engineering** (Hons Class 1 and the University Medal), Industrial Chemistry, UNSW School of Chemical Engineering, Sydney, Australia

**Highlights:** University Medal in Industrial Chemistry, The Era Polymers Prize in Industrial Chemistry for best research project, Co-op scholarship

2004 **Higher School Certificate** (University Admissions Index 98.95), The Illawarra Grammar School, Wollongong, Australia

**Highlights:** Dux of The Illawarra Grammar School, NSW Premier's Award for all-round excellence in the Higher School Certificate

## Industrial experience

- BlueScope Steel Research (Dec 2007 – Jan 2009)
- Siemen's Water Technologies (Dec 2006 – Feb 2007)
- Sydney Water (Dec 2005 – Feb 2006)

## Project management experience

Orientation Week Coordinator at Arc@UNSW (May 2010-May 2011) – responsible for the organisation of the largest event in the university calendar with a staff of ~150 volunteers and a budget of ~AUD200,000

## Publications

- M Christian et al, "Bioinspired Design of Graphene-Based Materials" *Advanced Functional Materials* (2020) 30, 2007458, **inside cover**
- E Musella et al, "Electrosynthesis of Ni/Al layered double hydroxide and reduced graphene oxide composites for the development of hybrid capacitors" *Electrochimica Acta* (2021) 365, 137294
- Musella, E. et al, "Electrosynthesis and characterization of Layered Double Hydroxides on different supports" *Applied Clay Science* (2020) 202, 105949
- Backes, C. et al, "Production and processing of graphene and related materials" *2D Materials* (2020) 7, 022001
- Musella, E. et al, "Electrochemical approach for the production of layered double hydroxides with a well-defined Co/Me (III) ratio" *Chemistry-A European Journal* (2019) 25, 16301-16310
- Magnabosco, G. et al, "Bionic synthesis of magnetic calcite skeletal structure through living foraminifera" *Materials Horizons* (2019) 6, 1862-1867
- Xia, Z., Christian, M. et al, "A robust, modular approach to produce graphene-MOx multilayer foams as electrodes for Li-ion batteries" *Nanoscale* (2019) 11, 5265-5273
- Xia, Z. et al, "Dispersion stability and surface morphology study of electrochemically exfoliated bilayer graphene oxide" *The Journal of Physical Chemistry C* (2019) 123, 15122-15130
- Musella, E. et al, "Newly developed electrochemical synthesis of Co-based layered double hydroxides: toward noble metal-free electro-catalysis" *Journal of Materials Chemistry A* (2019) 7, 11241-11249
- Kovtun, A. et al, "Benchmarking of graphene-based materials: real commercial products vs. ideal graphene" *2D Materials* (2019) 6, 025006
- Gualandi, I. et al, "Ni/Al Layered Double Hydroxide and Carbon Nanomaterial Composites for Glucose Sensing" *ACS Applied Nano Materials* (2019) 2, 143-155
- Iacobucci, M. et al, "Three-dimensional microporous graphene decorated with lithium" *Nanotechnology* (2018) 29, 405707
- Michail, A. et al, "Controllable, eco-friendly, synthesis of highly crystalline 2D-MoS2 and clarification of the role of growth-induced strain" *2D Materials* (2018) 5, 035035

- D'Arrigo, G. et al, "Mechanical and electrical characterization of CVD-grown graphene transferred on chalcogenide Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub> layers" *Carbon* (2018) 132, 141-151
- Pierleoni, D. et al, "Selective Gas Permeation in Graphene Oxide-Polymer Self-Assembled Multilayers" *ACS Applied Materials & Interfaces* (2018) 10, 11242-11250
- Rea, R. et al, "Permeability and Selectivity of PPO/Graphene Composites as Mixed Matrix Membranes for CO<sub>2</sub> Capture and Gas Separation" *Polymers* (2018) 10, 129
- Durso, M. et al, "Biomimetic graphene for enhanced interaction with the external membrane of astrocytes" *Journal of Materials Chemistry B* (2018) 6, 5335-5342
- Christian, M. et al, "Synthesis of high-density graphene foams using nanoparticle templates" In: Morandi, V., Ottaviano, L. (eds) *GraphITA. Carbon Nanostructures*. Springer, Cham (2017)
- Clochard, M. et al, "Large area fabrication of self-standing nanoporous graphene-on-PMMA substrate" *Materials Letters* (2016) 184, 47-51
- Ippoliti, R. et al, "Supramolecular self-assembly of graphene oxide and metal nanoparticles into stacked multilayers by means of a multitasking protein ring" *Nanoscale* (2016) 8, 6739-6753
- Ferroni, M. et al, "STEM electron tomography in the Scanning Electron Microscope" *Journal of Physics: Conference Series* (2015) 644, 012012
- Pierleoni, D. et al, "Graphene-based coatings on polymer films for gas barrier applications" *Carbon* (2015) 96, 503-512
- Matschullat, J. et al, "An interhemispheric perspective on environment and energy" *International Journal of Performability Engineering* (2015) 11, 589-603
- Lai, Q.; Christian, M.; Aguey-Zinsou, K.-F., "Nanoconfinement of borohydrides in CuS hollow nanospheres: A new strategy compared to carbon nanotubes" *International Journal of Hydrogen Energy* (2014) 39, 9339-9349
- Christian, M.; Aguey-Zinsou, K.-F., "Synthesis of core-shell NaBH<sub>4</sub>@M (M = Co, Cu, Fe, Ni, Sn) nanoparticles leading to various morphologies and hydrogen storage properties" *Chemical Communications* (2013) 49, 6794-6796
- Christian, M.; Aguey-Zinsou, K.-F., "Core-shell strategy leading to high reversible hydrogen storage capacity for NaBH<sub>4</sub>" *ACS Nano* (2012) 6, 7739-7751
- Marshall, D. et al, "Oxidation of 4-substituted TEMPO derivatives reveals modifications at the 1- and 4-positions", *Organic & Biomolecular Chemistry* (2011) 9, 4936-47
- Christian, M.; Aguey-Zinsou, K.-F., "Destabilisation of complex hydrides through size effects" *Nanoscale* (2010) 2, 2587-2590

## Conference presentations

- Promoting Applied Sciences in Pakistan e-conference, July 20-21 2020 (Zoom), **invited** oral: "A year on White Mars"
- Materials.it, Oct 22-26 2018 (Bologna, Italy), oral x2: "CVD synthesis of graphene on porous stainless steel" and "Graphene-enhanced loop heat pipes for space applications"
- Graphene Week, Sep 10-14 2018 (San Sebastián, Spain), poster: "CVD synthesis of graphene on porous stainless steel" and **invited** panellist: "Open Forum" discussion on bringing graphene and its applications to market
- ChemOnTubes, Apr 22-26 2018 (Biarritz, France), oral: "Graphene foam composites for high performance Li ion batteries"
- Graphene Study, Feb 5-10 2018 (Oberurgl, Austria), poster, **Best Poster Prize**: "Energy storage in 3D graphene composites"
- Graphene Week, Sep 25-29 2017 (Athens, Greece), oral: "Energy storage in graphene foam composites"
- Graphene 2017, Mar 28-31 2017 (Barcelona, Spain), oral: "Energy storage in 3D graphene composites"
- Materials.it, Dec 12-16 2016 (Catania, Italy), oral: "Development of 3D graphene structures and

- their promising energy applications”
- NanoInnovation, Sep 20-23 2016 (Rome, Italy), **invited** oral: “Development of 3D graphene structures and their prospective applications”
  - Graphene Week, Jun 13-17 2016 (Warsaw, Poland), oral: “From synthesis to applications: size-controlled functional graphene foams”
  - e-MRS Spring, May 2-6 2016 (Lille, France), poster: “The road to application for graphene foams of all shapes and sizes”
  - Graphene 2016, Apr 19-22 2016 (Genoa, Italy), oral: “Size-controlled functional graphene foams for energy applications”
  - FisMat, Sep 28-Oct 2 2015 (Palermo, Italy), poster: “Graphene foams to tune the benefits of 2D materials for a 3D world”
  - GraphITA, Sep 14-18 2015 (Bologna, Italy), poster: “Graphene foams to tune the benefits of 2D materials for a 3D world” and **local committee**
  - Humboldt Colloquium, Oct 19-22 2013 (Sydney, Australia), poster: “Awakening the potential of nanomaterials for hydrogen storage”
  - Universitas21 Graduate Research Conference on Energy, Jun 19-22 2013 (Dublin, Ireland), poster, **Best Poster Prize**: “Nano tricks for a reversible hydrogen storage solution”
  - The 1st European Early Stage Researchers’ Conference on Hydrogen Storage, Dec 3-5 2012 (Belgrade, Serbia), oral, **Best Oral Presentation Award**: “Achieving high capacity reversible hydrogen storage: NaBH<sub>4</sub>@Ni core-shell nanoparticles”
  - AIE2012, Nov 19-20 2012 (Sydney, Australia), poster: “A fuel of the future – making hydrogen energy feasible”
  - ARCCFN, Nov 15-16 2012 (Sydney, Australia), oral: “NaBH<sub>4</sub>@Ni Core-Shell Nanoparticles: A High-Capacity Reversible Hydrogen Store”
  - MH2012, Oct 21-26 2012 (Kyoto, Japan), poster, **Best Poster Prize**: “NaBH<sub>4</sub>@Ni Core-Shell Nanoparticles: A High-Capacity Reversible Hydrogen Store”
  - SET2011, Sep 4-8 2011 (Istanbul, Turkey), oral: “Hydrogen storage: size effects in complex hydrides”
  - Chemeca2010, Sep 26-29 2010 (Adelaide, Australia), oral: “Effect of size on the hydrogen storage properties of complex hydrides”
  - RACI2010, Jul 4-8 2010 (Melbourne, Australia), oral: “Effect of size on the hydrogen storage properties of complex hydrides”

## Technical skills

Atmospheric aerosol measurements, Chemical Vapour Deposition, Differential Scanning Calorimetry, Fourier Transform Infrared Spectroscopy, Graphene Transfer, Mass Spectrometry, Nanoparticles synthesis, Optical Microscopy, Raman Spectroscopy, routine meteorological measurements, Scanning Electron Microscopy, stratospheric and tropospheric lidar, surface radiation measurements, Thermo Gravimetric Analysis, Transmission Electron Microscopy, X-Ray Diffraction, X-Ray Photoelectron Spectroscopy