

# Achraf Nouredine

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## EDUCATION

- **Ph.D. Chemical and Nano-Engineering** School of Chemical Engineering of Montpellier (France) 2014
- **M.Sc. Chemical Processes Engineering** University of Lille (France) 2011
- **B.Sc. Chemistry** University of Lille (France) 2009

## RESEARCH INTERESTS

- **Sol-Gel Engineering of Materials:** Design and characterization of mesoporous silica, organosilica, silsesquioxanes micro- and nanoparticles.
- **Nanoparticles Architecture:** Control of the size, structure, pore size of porous silica nanoparticles.
- **Protocell Technology:** Creation of liposomes and fusion of their properties with siliceous nanoparticles.
- **Sol-Gel 3D Printing:** Design of mesoporous silica dots on optic fibers and flat surfaces.
- **Nanotechnology and Nanomedicine:** cancer treatment, drug delivery, gene editing, immunotherapy, biosensors.
- **Nanotechnology and Catalysis:** Noble-metals nanoclusters, porous structures, energy applications, petrochemistry.

## PROFESSIONAL EXPERIENCE

- **Research Assistant Professor** University of New Mexico (USA) 03/2019-present  
Department of Chemical and Biological Engineering. Submitting proposals, conducting top-notch research on the materials/Biology interface, presenting our research in national meetings, building collaborations.
- **Postdoctoral Fellow** University of New Mexico (USA) 02/2016-02/2019  
Center for micro-engineered materials. PI: Prof. C. Jeffrey Brinker. Leading the nanomaterials engineering in the group for various application including cancer therapy, CRISPR gene editing, immunotherapy, bacterial responses, catalysis.
- **European Center of Ceramics (Limoges, France)** 12/2014-01/2016  
Institute of Ceramics Research. PI: Prof Martine Lejeune. Creation of mesoporous silica microdots on optic fibers for early detection of aerodigestive tract cancer. Close collaboration with Kamax Innovative System Company.
- **Graduate Researcher Assistant** School of Chemical Engineering of Montpellier (France) 10/2011-11/2014  
Laboratory of Molecular and Nanomaterials Architecture. PIs: Prof. Xavier Cattoën and Prof. Michel Wong Chi Man. Creating clickable silica and organosilica based materials for cancer therapy and engineering surface properties.
- **Research Associate** University of California Los Angeles-UCLA (USA) 03/2013-06/2013  
Department of Chemistry and Biochemistry, PI: Prof. Jeffrey Zink. Creating light-triggered clickable nanomachine
- **Research Associate** University of Pierre and Marie Curie Paris VI (France) 02/2011-07/2011  
Laboratory of Surface Reactivity, PI: Prof. Franck Launay. Synthesis, characterization and application of rhodium-doped Al-SBA-15 materials in dehydrogenation of aromatics.
- **Research Associate** University of Lille (France) 09/2009-12/2009  
Laboratory of Materials Transformation, PIs: Prof. Maryse Bacquet and Prof. Bernard Martel. Eco-conception of ion-exchange textile for water decontamination.

## **TEACHING, MENTORSHIP and MANAGEMENT**

■ **Laboratory Manager** UNM Nanomedicine Lab 01/2019 - present

■ **Laboratory co-Manager** UNM Nanomedicine Lab 2017-12/2018

Organization of different lab aspects (Instruments and personnel's safety, lab tours, chemical database)

■ **Teaching Assistant** UNM 10/2017-12/2017

Assisting Prof C.J. Brinker in teaching Nanoparticles Therapeutics class (CBE 361)

■ **Laboratory Advisor** Chemical Engineering School (Montpellier) 2011-2014

Responsible of the Laboratory (Chemistry of Materials) of Chemical engineering seniors (synthesis and characterization of inorganic materials, safety, grading)

■ **Nanoengineering Coach** UNM-Sandia NL 2017-2018

Teaching the engineering of silica-based nanoparticles for 3 postdocs and 1 technologist at Sandia National Labs.

■ **Laboratory Mentor** UNM 08/2016-present

Mentor of 2 PhD student, 2 master, 20 undergrads, 4 high school from several national and international institutions (UNM, Universidad Complutense de Madrid, University of Namur, Kent State University, NM State University, Manzano High School)

■ **Laboratory Mentor** European Center for Ceramics (Limoges, France) 2015

Mentor of one PhD student and managing contact with Kamax Innovative Systems Inc.

## **AWARDS and MERIT SCHOLARSHIPS**

■ **Best Poster Prize** UNM STEM day (Albuquerque, USA) 03/2019

"The endocytotic fate of a mesoporous silica nanoparticle supported lipid bilayer CRISPR delivery vehicle"  
Angelea Maestas, Achraf Nouredine, Rita Serda, Jeffrey Brinker

■ **State Finalist (Top 10)** New Mexico RainForest 90-Seconds Pitch 11/2018

Uncommon advanced-stage ovarian cancer therapy

■ **Best Poster Prize** American Institute for Chemical Engineers (Pittsburgh, USA) 10/2018

UNM Comprehensive Cancer Center Research Symposium (NM, USA) 05/2018

"The endocytotic fate of a mesoporous silica nanoparticle supported lipid bilayer CRISPR delivery vehicle"  
Angelea Maestas, Achraf Nouredine, Rita Serda, Jeffrey Brinker

■ **Best Poster Prize at New Mexico Science & Engineering Fair (Albuquerque, USA)** 2018

and ■ **Gold Medal in 2 categories (Biology & Biochemistry) National ACT-SO Competition (San Antonio, USA)**

and ■ **Second Place Winner in Biomedical Health and Medicine Category at Intel International Science and Engineering Fair-ISEF (Pittsburgh, USA)**

"Optimization of Lipid-Coated Mesoporous Silica Nanoparticles for Cancer Immunotherapy"

Lien Tang, Achraf Nouredine, Karen Sanchez, Henning de May, Jeffrey Brinker, Sarah Adams, Rita Serda

■ **Best Poster Prize** American Institute for Chemical Engineers (Minneapolis, USA) 11/2017

"Potential of Mesoporous Silica Nanoparticles as Small Delivery Platform against Pathogenic Bacteria"

Misché Hubbard, Jacob Agola, Achraf Nouredine, Jeffrey Brinker

■ **Limousin County Research Scholarship** European Center of Ceramics (Limoges, France) 12/2014

Grant to conduct postdoctoral research: Ink-jet printed silica micro-biosensors

- **THERANOSTIC Scholarship**                      **French National Agency for Research (Limoges, France)**                      **12/2014**  
Grant to conduct postdoctoral research: 3D-printed silica microdots for cancer early biosensing
- **Mobility Scholarship**                              **Program University Funds-PUF (Los Angeles, USA)**                      **03/2013**  
A semester-long research grant at UCLA (spring 2013, Prof. Jeffrey Zink group) within the Ph.D. program:  
Development of stimuli-triggered clickable nanomachines
- **Ph.D. Scholarship**                                      **Ministry of Education and Research, (Montpellier, France)**                      **10/2011**  
Development of clickable nanomaterials for diverse medical purposes
- **Master's Thesis Scholarship**                      **University of Pierre and Marie Curie (Paris, France)**                      **03/2011**  
Implementation of noble metals-encapsulated Al-SBA15 materials for catalytic applications
- **Outstanding student award**                      **Faculty of Science V, Lebanese University, Lebanon**                      **07/2008**  
(B.S. Junior, ranked 1<sup>st</sup>/52)

## **PUBLICATIONS**

- W. Zhu, J. Guo, S. Amini, Y. Ju, J. O. Agola, A. Zimpel, J. Shang, **A. Nouredine**, F. Caruso, S. Wuttke, J. G. Croissant, C. J. Brinker, "SupraCells: Living Mammalian Cells Protected within Functional Modular Nanoparticle-Based Exoskeletons", **Advanced Materials**, just accepted, DOI: 10.1002/adma.201900545
- W. Zhu<sup>+</sup>, **A. Nouredine**<sup>+</sup>, J. Howe, J. Guo, C.J. Brinker\*, "Conversion of Metal-Organic Cage to Ligand-Free Ultrasmall Metal Nanocluster Catalysts Confined within Mesoporous Silica Nanoparticle Supports", **Nanoletters**, (2019) <sup>+</sup> co-first authors
- P. Dogra, N. L. Adolphi, Y-S. Lin, K. S. Butler, P. N. Durfee, J. G. Croissant, **A. Nouredine**, E. N. Coker, E. L. Bearer, Z. Wang, V. Cristini,\* C. J. Brinker,\* "Establishing the Effects of Physicochemical Properties and Routes of Administration on In Vivo Nanoparticle Disposition," **Nature Communication**. 9, 1-14 (2018)
- LaBauve, A. E.; Rinker, T.; **Nouredine, A.**; Serda, R.; Sherman, M.; Howe, J.; Rasley, A.; Brinker, C. J.; Sasaki, D.; Negrete\*, O. A. Lipid-Coated Mesoporous Silica Nanoparticles for the Delivery of the ML336 Antiviral to Inhibit Encephalitic Alphavirus Infection. **Sci. Rep.** 8, 1-13 (2018)
- **Nouredine, A.**; Hjervik, E. A.; Croissant, J. G.; Durfee, P. N.; Agola, J. O.; Brinker, C. J.\* Engineering of large-pore lipid-coated mesoporous silica nanoparticles for dual cargo delivery to cancer cells. **J. Sol-Gel Sci. Technol.** (2018).
- Villegas, M. R.; Baeza, A.\*; **Nouredine, A.**; Durfee, P. N.; Butler, K. S.; Agola, J. O.; Brinker, C. J.\*; Vallet Regi, Maria\*. Multifunctional Protocells for Enhanced Penetration in 3D Extracellular Tumoral Matrices. **Chem. Mater.** 30, 112–120 (2018). Subject to a [press release](#) of the American Chemical Society.
- **Nouredine, A.\*** & Brinker, C. J.\* Pendant / bridged / mesoporous silsesquioxane nanoparticles: Versatile and biocompatible platforms for smart delivery of therapeutics. **Chem. Eng. J.** 340, 125–147 (2018).
- **Nouredine, A.**; Gary-Bobo, M.; Lichon, L.; Garcia, M.; Zink, J. I.; Wong Chi Man\*, M.; Cattoën, X.\* Bis-clickable Mesoporous Silica Nanoparticles: Straightforward Preparation of Light-Actuated Nanomachines for Controlled Drug Delivery with Active Targeting. **Chem. - A Eur. J.** 22, 9624–9630 (2016).
- **Nouredine, A.**; Lichon, L.; Maynadier, M.; Garcia, M.; Gary-Bobo, M.; Zink, J. I.; Cattoën, X.\*; Wong Chi Man, M.\* Controlled multiple functionalization of mesoporous silica nanoparticles: homogeneous implementation of pairs of functionalities communicating through energy or proton transfers. **Nanoscale** 7, 11444–11452 (2015).
- **Nouredine, A.**, Trens\*, P., Toquer, G., Cattoën, X.\* & Wong Chi Man, M.\* Tailoring the hydrophilic/lipophilic balance of clickable mesoporous organosilicas by the copper-catalyzed azide-alkyne cycloaddition click-functionalization. **Langmuir** 30, 12297–12305 (2014).

■ Bürglová<sup>+</sup>, K.; **Noureddine<sup>+</sup>, A.**; Hodačová, J.; Toquer, G.; Cattoën, X.\*; Wong Chi Man, M.\* A general method for preparing bridged organosilanes with pendant functional groups and functional mesoporous organosilicas. **Chem. - A Eur. J.** 20, 10371–10382 (2014).

■ Cattoën, X.\*; **Noureddine, A.**; Croissant, J.; Moitra, N.; Bürglová, K.; Hodačová, J.; De Los Cobos, O.; Lejeune, M.; Rossignol, F.; Toulemon, D.; Bégin-Colin, S.; Pichon, B. P.; Raehm, L.; Durand, J. O.; Wong Chi Man, M. Click approaches in sol-gel chemistry. **J. Sol-Gel Sci. Technol.** 70, 245–253 (2014).

### **BOOK CHAPTERS**

■ S. Shenoï-Perdoor, **A. Noureddine**, F. Dubois, M. Wong Chi Man, X. Cattoën\*; Click Functionalization of sol-Gel Materials. Handbook of Sol Gel Chemistry; 2016. **3 citations**

■ **A. Noureddine**, J. G. Croissant, H. O. Davis, L. I. Friedrich, R. E. Serda\*; Nanoparticle Vaccines for Immunotherapy: From Design to Clinical Trials 2018, *submitted invited chapter*

### **PATENTS**

■ K. Butler, A. Muniz, **A. Noureddine**, C.J. Brinker. Multilamellar Particles and Methods Thereof; Provisional application filed, 2017.

■ **A. Noureddine**, E. Hjelvik, C.J. Brinker. Starry Monodisperse Silica Nanoparticles with Ultra Large Mesopores; Provisional application filed, 2018

■ R. Serda, K. Sanchez, K. Baty, C.J. Brinker, **A. Noureddine** Immunogenic Lipid Encapsulated Mesoporous Silica Nanoparticles Of Cancer Immunotherapy; Provisional application filed, 2018

■ R. Serda, **A. Noureddine**. A High Capacity Nanoparticle Platform for Immunogenic Cell Death; Provisional application filed, 2018

### **PROCEEDINGS**

■ E. Hjelvik, **A. Noureddine**, J. Agola, J.G. Croissant, C.J. Brinker. Fine-Tuned Nanoparticles Synthesis for Controlled Pore Size and Condensation Degree, *Abstracts of Papers of the American Chemical Society*, 255, 2018

■ D. Sasaki, C. Dolstra, **A. Noureddine**, C.J. Brinker. Cargo release mechanics of lipid bilayer coated mesoporous silica nanoparticles. *Abstracts of Papers Of The American Chemical Society*, 255, 2018

■ K. Butler, R. Serda, **A. Noureddine**, A. Muniz, D. Sasaki, O. Negrete, C. J. Brinker. Efficient CRISPR delivery via plasmid DNA (or ribonucleoprotein, RNP) packaged in mesoporous silica nanoparticles through cationic vesicle fusion. *Abstracts of Papers of The American Chemical Society* 254, 2017

■ K. Butler, P. Durfee, W. Wharton, **A. Noureddine**, I. Chen, C. Willman, C. J. Brinker, D. Teachey, D. Barrett, S. Grupp. Active targeting and Small Molecule Delivery to Individual Leukemia Cells Utilizing Mesoporous Silica Nanoparticle-Supported Bilayers (Protocells). *Sandia National Lab.(SNL-NM), Albuquerque, NM, USA* 2017

■ **A. Noureddine**, J. Croissant, M. Gary-Bobo, M. Garcia, M. Maynadier, J.O. Durand, M. Wong Chi Man, X. Cattoën. Multiple functionalization of silica-based materials by click chemistry. *NanoApp* 2017

■ K. Butler, R. Serda, **A. Noureddine**, A. Muniz, D. Y. Sasaki, O. Negrete, C.J. Brinker. Responsive Programmable Assembly of Active Colloids for Functional Materials. *Sandia National Lab (SNL-NM), Albuquerque, NM, USA; Sandia National Laboratories, Livermore, CA, USA* 2017

■ **A. Nouredine**, J. Graffion, R. Trihan, O. De Los Cobos, M. Lejeune, F. Rossignol, C. Lefort, L. Micallef, H. Akil, F. Lalloué, J. Desroches, O. Baudet, M. Poncelet. Ink-Jet Printed Mesoporous Silica Microdots on Optical Fiber: Towards Endoscopic Devices for Early Detection and Therapy Of Cancer. *NanoApp* **2015**

### **PRESENTATIONS AND INVITED TALKS**

■ The contributions of STC.UNM in creating scientists-entrepreneurs, STC Board of Directors Meeting, Albuquerque, NM, USA; **04/2019**

■ Ligand-Free Ultrasmall Metal Nanocluster Catalysts Confined in Mesoporous Silica Nanoparticles. Rocky Mountain Catalysis Society meeting, Manufacturing Training and Technology Center Albuquerque NM, USA; **04/2019**

■ Immunogenic Nanoparticles: A new era of cancer-curative vaccines. ACS meeting Orlando FL, USA; **03/2019**

■ How does NSF Icorps Program participate in New Mexico Economic development?, UNM Economic Development Council meeting, Albuquerque, NM, USA; **01/2019**

■ Introduction to Silica Nanoparticles and Protocell Technology. Department of Chemical and Biological Engineering, Nanomedicine Lab Seminar Albuquerque NM, USA; **07/2018**

■ Immunogenic Nanoparticles as a Cancer Vaccine: The Combo Combat. UNM Comprehensive Cancer Center Research Symposium; Albuquerque, NM, USA; **05/2018**

■ Mesoporous Silica Nanoparticles in Nanomedicine: Biocompatibility and Therapeutics Release. American Association of Pharmaceutical Sciences, Albuquerque, NM, USA; **09/2017**

■ Degradability and Clearance of Mesoporous Silica Nanoparticles. Department of Chemical and Biological Engineering, Nanomedicine Lab Seminar Albuquerque NM, USA; **03/2017**

■ Large Pores Silica Nanoparticles for Loading and Delivery of CRISPR Components. Department of Chemical and Biological Engineering, Nanomedicine Lab Seminar Albuquerque NM, USA; **09/2016**

■ Ink-Jet Printed Mesoporous Silica Microdots on Optical Fiber: Towards Endoscopic Devices for Early Detection and Therapy of Cancer. NANOAPP conference, Maribor Slovenia; **06/2015**

### **PROFESSIONAL SERVICE**

■ Reviewer in Scientific papers: ACS applied materials and interfaces, Silicon

■ PhD Theses Examination (Ramadan, PI Luyt, University of the Free State, South Africa)

■ Judge in UNM research day

## **REFERENCES**

### **Pr. C. Jeffrey Brinker**

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### **Pr. Jeffrey I. Zink**

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### **Pr. Michel Wong Chi Man**

Research Director French National Center for Scientific Research (Ph.D. Advisor)

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### **Pr. Xavier Cattoën**

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### **Pr. Martine Lejeune**

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