Shalom Menny – C.V.

Personal Details

Name	Menny Shalom
Date and place of birth	08/11/79 – Tel-Aviv, Israel
Address and telephone number at work	Ben-Gurion University of the Negev Beer-Sheva, 84105, Israel, 08-6428202
Address and telephone number at home	Pasos 9, Lehavim, 052-567-7117

Education

2004-2007 B.Sc., *summa cum laude*, Chemistry Department, Bar-Ilan University, Israel.

2007-2009 M.Sc., *summa cum laude*, Chemistry Department, Bar-Ilan University, Israel.
Topic: Improving and Understanding of Quantum Dots Sensitized Solar Cells: Synthesis Characterization and Application. Supervisor: Prof. Arie Zaban.

2009-2012 Ph.D. Student, Chemistry Department, Bar-Ilan University, Israel.
Topic: Understanding The Mechanisms in Quantum Dot Sensitized Solar Cell
Towards Innovative Design, Synthesis and Fabrication of Efficient Quantum Dot (QD) Based Solar Cells. Supervisor: Prof. Arie Zaban.

Employment History

2016- Associate Professor, Chemistry Department, Ben-Gurion University of the Negev, Beer Sheva, Israel

2014-2016 Group Leader, Department of Colloid Chemistry, Max-Planck Institute of Colloids and Interfaces, Germany.
Supervisor: Prof. Markus Antonietti.

2012- 2014 Postdoctoral Associate Researcher, Department of Colloid Chemistry, Max-Planck Institute of Colloids and Interfaces, Germany.
Supervisor: Prof. Markus Antonietti.

Professional Activities

- Co-organizer of a symposium at the nanoGe Fall Meeting 20, Barcelona 2020.
- Organizer of the Max Planck Institute of Colloids and Interfaces - Weizmann Institute of Science Symposium, 3-5 November 2014.
- Member in Helmholtz-Israel International Research School on Hybrid Integrated Systems for Conversion of Solar Energy (HI-SCORE).
- Referee service for Journals: Nature, Nature Catalysis, Science Advance, J. Am. Chem. Soc., Nature Commun., Adv. Mater, Angew. Chem. Int. Ed., Joule, Nano Lett., Adv. Func. Mater., Adv. Energ. Mater., Chem. Sci, J. Phys. Chem. Lett., ChemComm., J. Mater. Chem. A, Small, J. Phys. Chem. C, Electrochimica Acta, Sci. Rep.

Educational activities

(a) Courses taught

2017-2018 Introduction to semiconductors (Grad students 2hr/week)

2018- Kinetics of Chemical Reactions (1nd year students, 2 hr/week)

2017-2018 Analytical Chemistry Lab for Chemists, (1st year students, 6 hr/week)

2018 Physical Chemistry Lab for Chemical Engineering (2nd year students, 4 hr/week)

(b) Research Students

Past students (Max Planck institute)

Postdocs

Dr. Jingsan Xu (11.2013-11.2015), Dr. Xiaofei Yang (1.2014-6.2015), Dr. Sarina Sarina (12.2014-12.2015), Dr. Yubao Zhao (03.2016- 10.2017)

PhD students

Thomas Jordan, “CxNy-materials from supramolecular precursors and their “All-Carbon”-composite-analogues from different carbon-derivatives”, University of Potsdam, 2017.

Marc Ledendecker. “Advanced nickel based materials for the water splitting reaction”, University of Potsdam, 2017.

Lina Li, “The synthesis of carbon nitride materials for artificial photosynthesis”, University of Potsdam, 2018.

Past students (Ben Gurion University)

Dr. Jingwen Sun (02.2017 – 02.2018) – Now Assistant Professor, Nanjing University of Technology.

Dr. Guiming Peng (02.2017- 12.2018) – Now Postdoctoral researcher in Chicago University

Current Students (Ben Gurion University)

Postdocs

Dr. Neeta Karjule (04.2018-)

Dr. Jiani Qin (10.2018-)

Dr. Jiawei Xia (03.2019-).

Dr. Ying Wang (08.2019-)

PhD and Msc students

Jesus Barrio Hermida, PhD student, (10.2016 -)

Jonathan Tzadikov, PhD student, (10.2016-, started as Msc student).

Adi Azoulay, PhD student (10.2017-, started as Msc student).

Junyi Li, PhD student (10.2019-).

Liel Abisdris, Msc student (10.2018-)

Ayelet Tashakory, Msc student (10.2019-)

Academic Awards, Citations, Honors, Fellowships

2018 Israel Vacuum Society (IVS), Early Career Research Excellence Award

2018 Toronto Prize for Excellence in Research

2013 Israel sustainable energy society prize for the best PhD thesis

2012 Best presentation award in Israel Electrochemistry Meeting, Tel-Aviv, 2012

2012 The Wolf Foundation Award for Excellent and Outstanding PhD. students

2012	Israel chemical society (ICS) prize for outstanding PhD. student
2011	Invitation to the "2011 World Materials Summit", Washington DC
2009	The Wolf Foundation Award for Excellent and Outstanding M.Sc. students
2007	Dean's list of outstanding students, B.Sc., Bar-Ilan University (best 3% of 150 students)
2007	The Wolf Foundation Award for Excellent and Outstanding B.Sc. students
2006	Rector's list of outstanding students, B.Sc., Bar-Ilan University (the best student out of 130 students)

Academic Scholarships

2012-2013	Minerva fellowship for post-doctoral research
2009-2012	Converging Technologies: Three years' scholarship for outstanding Ph.D. student.
2009	Nanotechnology scholarship: One-year scholarship for outstanding Ph.D., Bar-Ilan University.
2008	Nanotechnology scholarship: One-year scholarship for outstanding M.Sc., Bar-Ilan University.
2005	The Faculty of Exact Sciences, One-year scholarship for outstanding B.Sc. Students, Bar Ilan University.

Selected invited conferences / colloquia presentations

1. “Supramolecular approach for the synthesis of ordered carbon nitride structures for Photo and Electro Chemical Applications”, Wuhan, China, 2015. Plenary talk.
2. “Supramolecular Preorganization of Monomers for the Growth of Carbon Nitride Materials”, International Conference on "Novel nanomaterial: engineering and properties", Soleil, France, 2015.
3. “Carbon Nitride Materials for Artificial Photosynthesis”, 2nd Molecules and Materials for Artificial Photosynthesis Conference, Cancun, Mexico, 2016.
4. “Carbon Nitride and Nickel based Materials for Energy Related Applications”, Southeast University, Nanjing, 2016.
5. “Carbon Nitride and Nickel based Materials for Energy Related Applications”, Nanjing University of Science and Technology, China, 2016.
6. “Carbon Nitride Materials for Photochemical Applications” Cluster of Excellence (UniCat) Technische Universität Berlin, Germany, 2016.
7. “New Organic Semiconducting Scaffolds by Supramolecular Preorganization”, 82nd Meeting of Israel Chemical Society, Israel, 2017.
8. “Graphitic Carbon Nitride Layers as Light-harvesting Semiconductors for Photoelectrochemical Cells”, The 6th OASIS International Conference and Exhibition on Optics and Electro-Optics, Israel, 2017
9. “Carbon Nitride and Nickel based Materials for Energy Related Applications”, Catalan Institute of Chemical Research (ICIQ), Spain, 2017.

10. “Graphitic Carbon Nitride Layers as Light-harvesting Semiconductors for Photoelectrochemical Cells”, Seda Boker, Israel, 2017.
11. “Carbon Nitride Materials for Photochemical Applications”, International Conference on 2D Nanomaterials Synthesis and Applications (2DSA17), Barcelona, Spain, 2017.
12. “Graphitic Carbon Nitride Layers as Light-harvesting Semiconductors for Photoelectrochemical Cells”, Israel Sustainable Energy Society Annual Meeting, Israel, 2017.
13. “Carbon Nitride Materials for Photochemical Applications”, Israel-Turkey workshop on Nanoscience & Nanotechnology, Weizmann Institute of Science, Israel, 2017.
14. “Graphitic Carbon Nitride Layers as Light-harvesting Semiconductors for Photoelectrochemical Cells”, 3nd Molecules and Materials for Artificial Photosynthesis Conference, Cancun, Mexico, 2018.
15. "Synthesis of carbon nitride based materials for solar fuel production", Tel Aviv University, 2018.
16. "Graphitic Carbon Nitride Layers as Light-harvesting Semiconductors for Photoelectrochemical Cells", Nano Israel, Jerusalem, 2018.
17. "Graphitic Carbon Nitride Layers as Light-harvesting Semiconductors for Photoelectrochemical Cells", Solar Fuel Fall Meeting, Torremolinos, Spain, 2018.
18. "Graphitic Carbon Nitride Layers as Light-harvesting Semiconductors for Photoelectrochemical Cells", International Symposium on Energy Conversion and Storage Materials Conference 2019, Brisbane, Australia, 2019.
19. "Synthesis of Carbon Nitride Based Materials for Solar Fuel Production", University of Munich (LMU), Germany, 2019.

Research Grants and Funds

1. 2014-, Ben-Gurion University of the Negev start-up grant $650,000
2. 2017-2021 Israel Science Foundation (ISF), personal research grant number 1161/17, "Exploring graphitic carbon nitride layers as light-harvesting semiconductors for use in water-splitting photoelectrochemical cells", $400,000 (4 years).
3. 2017-2019, Israel Science Foundation (ISF), equipment research grant number 2343/17. $250,000.
4. 2018-2024, Minerva Center, grant number 117873, $132,000 (6 years)
5. 2018-2021, Israel National Research Center for Electrochemical Propulsion (INREP) center, $183,000 (3 years).
6. 2019-2021 Israel Science Foundation (ISF) - National Natural Science Foundation of China (NSFC), research grant number 2969/19, "Heteroatom-incorporating polymeric carbon nitride-based films for photo(electro)catalysis", $300,000 (3 years).
7. 2020-2025, ERC Starting Grant 2019 (ERC-2019-StG): Controlled Growth of Lightweight Metal-Free Materials for Photoelectrochemical Cells (MFreePEC), $ 1,650,000.

Synopsis of research

Metal Free Carbon Nitride-Based Materials

While most of the research in this field is focused on metal based semiconductors (metal oxides, sulfides and nitrides) as photocatalysts, in the last year's metal-free graphitic carbon nitride (g-CN)

materials have attracted widespread attention due to their outstanding (electro)catalytic and photocatalytic activity. Despite of the great progress in g-C_3N_4 synthesis, it is still a standard problem of g-CN chemistry that only rather disorganized textures with small grain sizes are obtained. Therefore, it is essential to find new and simple synthetic pathways to form highly ordered structures of carbon nitride with controlled electronic, optical and catalytic properties.

Our group introduced new synthetic methods which are based on supramolecular chemistry approach to synthesize well-defined structures of g-CN such as hollow boxes, spheres and spherical macroscopic assemblies with the possibility to control their photophysical and photocatalytic properties. Supramolecular chemistry provides a great opportunity for the synthesis of nanostructured materials without any further templating techniques. The supramolecular approach includes the use of non-covalent interactions such as hydrogen bonding to form order between building blocks for the desired synthesis. The structure of the final products can be controlled by choosing the appropriate monomers and solvents for the synthesis.

Carbon Nitride based Photoelectrochemical cells

One of the most promising future sources of alternative energy involves water-splitting photoelectrochemical cells (PECs) – a technology that could potentially convert sunlight and water directly to a clean, environmentally-friendly, and cheap hydrogen fuel. Practical PEC-mediated hydrogen production requires robust and highly efficient semiconductors, which should possess good light-harvesting properties, a suitable energy band position, stability in harsh condition, and a low price. Despite great progress in this field, new semiconductors that entail such stringent requirements are still sought after. Recently, graphitic carbon nitride (g-CN) has emerged as a suitable photocatalyst for various reactions due to its tunable band gap, suitable energy band position, high stability, and low cost. However, the utilization of g-CN in PECs is still at an early stage, due to difficulties in acquiring a homogenous layer on a conductive substrate and the lack of fundamental understanding of the intrinsic layer properties of g-CNs.

For photoelectrochemical applications a direct connection between g-CN and the conductive substrates is needed. Due to the large particle size and the insolubility of g-CN in most solvents, the use of common deposition techniques such as spin-coating and screen-printing results in poor coverage and conductivity. Therefore, it is crucial to find a new and simple synthetic pathway to grow g-CN on different substrates. Using the supramolecular approach, we were able to grow highly ordered carbon nitride structures on different substrates both in solid state and liquid-based growth. Thanks to the new deposition methods, we were able to show, for the first time, the reduction of water to hydrogen using a metal-free g-CN electrocatalyst. Moreover, we found that the g-CN can act as an absorber and electron accepting layer in polymer solar cell which exhibits a remarkable open circuit voltage of 1 V as well as absorber and sensitizer in photoelectrochemical cells.

Ceramic Metals as Water Splitting Electrocatalysts

An important topic of our group is the development of new, low cost and efficient materials as electro and co-catalysts for energy related applications (i.e. water splitting). Electrochemical water splitting to hydrogen (HER) and oxygen (OER) plays a growing role in the fabrication of alternative energy

devices due to the need of clean and sustainable energy. Nickel-based materials have attracted enormous attention because of the flexible catalytic properties, along with low price and high abundance when compared to noble metals.

We developed a facile and easy synthesis of large- scale nanoporous, nickel based materials (Ni, Ni_5P_4, Ni_3N and Ni_3S_2), partly embedded in an amorphous matrix of a carbon-nitrogen material or directly grown on Ni substrates. Moreover, we demonstrated the ability to dope these materials with other metals (Mn, Co and Fe). The obtained materials show remarkable performance in the electrochemical production of hydrogen both in terms of low overpotential and high current densities. In addition, these materials exhibit high activity toward the oxygen evolution reaction (OER). In sum, the activity of these materials both for HER and OER result in a high overall water splitting efficiency. Currently, we are focusing on the development of new and abundant materials as (electro) catalysts for energy related applications along with a detail studies on the materials operation mechanism.