Michael Naguib Abdelmalak (Michael Naguib)

Ph.D. Candidate & Research and Teaching Assistant

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Research Areas of Interest

My passion in science belongs to the synthesis and characterization of novel and advanced functional nanomaterials for energy storage systems. Currently, I am focusing on a new family of two dimensional transition metal carbides, nitrides, and carbonitrides called *MXenes* that has shown great promise in the fields of energy storage and composite technology. In particular, I am investigating *MXenes* as novel anode materials in lithium ion batteries.

Academic Record and Education

- January 2010-Present: **PhD Candidate**, Drexel University, PA, USA.
  Major: **Materials Science and Engineering.**
  Advisors: Prof. Michel Barsoum and Prof. Yury Gogotsi.
  GPA: 3.99/4.00.
  Ph.D. Proposal Exam Passed: March 8, 2012.
  Ph.D. Candidacy Exam Passed: August 18, 2011.

- October 2007-December 2009: **Master of Engineering**, Cairo University, Egypt.
  Major: **Metallurgical Engineering.**
  M.Sc. Thesis Title: "The Effect of GTAW Heat Input on Mechanical Properties and Corrosion Resistance of Austenitic and Super-Austenitic Stainless Steels."

- September 2002-July 2007: **Bachelor of Engineering**, Cairo University, Egypt.
  Major: **Metallurgical Engineering.**
  Grade: **Distinction with Honors Degree.**
  Rank: **First of Class.**
  Graduation Project: "Synthesis and Characterization of Al_2O_3 Nano-Reinforced Bronze Alloys by Powder Metallurgy Technique."

Work Experience

- January 2010-Present: **Research and teaching assistant**
  MSE Department Drexel University, Philadelphia, USA.
  Accomplishments:
  - Synthesis a new family of *2-D* transition metals carbides and carbonitrides called *"MXene"* from ternary ceramic materials called *"MAX phases"* using HF.
  - Characterize materials using X-ray diffraction (XRD), scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDX), and Raman spectroscopy.

- Analyze results obtained from X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM), and seleced area electron diffraction (SAED), and gas sorption and BET.
- Assemble and test *lithium ion batteries* (LIBs) with new anode materials.
- Characterize LIBs using galvanostatic cycling, cyclic voltammetry tests, and electrochemical impedance spectroscopy.
- Assemble and test *sodium ion batteries* with new anode materials.
- Synthesis of hybrid transition metals oxides-carbon composites using different oxidation techniques such as hydrothermal treatments and gaseous oxidation, and test them for LIBs.
- Synthesis of new phases (Ti_2AlF_9, $Ti_5Al_2C_3$).

- **Assisting in teaching** "Introduction to Materials Science" (MATE 220) as a recitation instructor during spring 2010, and spring 2012.
- Ceramic lab instructor; ASM Materials Camp, Drexel University, Philadelphia, PA. (3 x 1-day events) during 2010-2012
- Ceramic lab instructor; MATE 100, Materials two-day course, Drexel University, Philadelphia, PA. (2 2-day events) during 2010-2012

- September 2007-December 2009: **Teaching assistant**
  Faculty of Engineering, Cairo University, Egypt.
  Accomplishments:
  - **Assisting in teaching** undergraduate courses (Material Science, Stress Analysis (Theory of Elasticity and Plasticity), Metal forming and Rolling, Physical Metallurgy, Mechanical Testing, Non Destructive Testing, and Material Selection)
  - F**ailure analysis investigations** for industrial metallic parts of several major companies. Testing of metals and work according to international specifications as ASTM, ASME, AWS, API, and EN.

Publications

Journal Articles Published/Accepted

2013

1. Mashtalir, O.; **Naguib, M.;** Mochalin, V.N.; Dall'Agnese, Y.; Heon, M; Barsoum, M.W.; Gogotsi, Y., Intercalation and Delamination of Layered Carbides and Carbonitrides, ***Nature Communications*** ***2013***, Just Accepted. **[Impact Factor: 7.396]**
2. Mashtalir, O.; **Naguib, M.;** Dyatkin, B.; Gogotsi, Y.; Barsoum, M.W., Kinetics of Aluminum Extraction from Ti_3AlC_2 in Hydrofluoric Acid, *Materials Chemistry and Physics* ***2013***, DOI: 10.1016/j.matchemphys.2013.01.008. **[IF: 2.234]**
3. Mashtalir, O.; Kurtoglu, M.; Pogulay, S.; Gogotsi, A.; **Naguib, M.;** Gogotsi, Y., Photocatalytic WO_3 and TiO_2 Films on Brass, *International Journal of Applied Ceramic Technology* ***2013,*** 10 (1), 26-32. **[IF: 1.384]**

2012

4. **Naguib, M.;** Mashtalir, O.; Carle, J.; Presser, V; Lu, J.; Hultman, L.; Gogotsi, Y.; Barsoum, M.W., Two-Dimensional Transition Metal Carbide, ***ACS Nano*** ***2012,*** 6 (2), 1322-1331. **[IF: 9.855]**

5. **Naguib, M.**; Come, J.; Dyatkin, B.; Presser, V.; Taberna, P-L.; Simon, P.; Barsoum, M. W.; Gogotsi, Y.; MXene: A Promising Transition Metal Carbide Anode Material for Lithium-ion Batteries, ***Electrochemistry Communications 2012,*** 16 (1), 61-64. **[IF: 4.846]**
6. Come, J.; **Naguib, M.**; Rozier, P.; Barsoum, M.W.; Gogotsi, Y. ; Taberna, P-L.; Morcrette, M.; Simon, P., A Non-aqueous Asymmetric Cell with a Ti_2C Based Two-Dimensional Negative Electrode, ***Journal of The Electrochemical Society 2012***, 159 (7) A1-A6. **[IF: 2.420]**
7. Lane, N.J.; **Naguib, M.**; Lu, J.; Eklund, P.; Hultman, L.; Barsoum, M.W., Comment on "$Ti_5Al_2C_3$: A New Ternary Carbide Belonging to MAX Phases in the Ti–Al–C System" *Journal of the American Ceramic Society* ***2012***, 95 (10), 3352-3354. **[IF: 2.167]**
8. Kurtoglu, M.; **Naguib, M.**; Gogotsi, Y.; Barsoum, M.W., First Principles Study of Two-Dimensional Early Transition Metals Carbides, ***MRS Communications 2012,*** 2 (4), 133-137. **[no IF yet]**
9. Presser, V.; **Naguib, M.**; Chaput, L.; Togo, A.; Hugd, G.; Barsoum, M.W., First-order Raman scattering of the MAX phases: Ti_2AlN, $Ti_2AlC_{0.5}N_{0.5}$, Ti_2AlC, $(Ti_{0.5}V_{0.5})_2AlC$, V_2AlC, Ti_3AlC_2, and Ti_3GeC_2, *Journal of Raman Spectroscopy* ***2012***, 43 (1),168-172. **[IF: 3.147]**
10. Lane, N.; **Naguib, M.**; Presser, V; Hugd, G.; Hultman, L.; Barsoum, M.W., First-Order Raman Scattering of the MAX phases Ta_4AlC_3, Nb_4AlC_3, Ti_4AlN_3 and Ta_2AlC, *Journal of Raman Spectroscopy* ***2012***, 43 (7), 954-958. **[IF: 3.147]**
11. Lane, N.J.; **Naguib, M.**; Lu, J.; Hultman, L.; Barsoum, M.W., Structure of a New bulk $Ti_5Al_2C_3$ MAX Phase Produced by the Topotactic Transformation of Ti_2AlC, *Journal of European Ceramic Society* ***2012***, 32 (12), 3485-3491. **[IF: 2.574]**
12. Tallman, D.; **Naguib, M.**; Anasori, B.; Barsoum, M.W., Tensile Creep of Ti_2AlC in the 1000-1150ºC Temperature Range, *Scripta Materialia* ***2012,*** 66 (10), 805-808. **[IF: 2.806]**

2011

13. **Naguib, M.**; Kurtoglu, M.; Presser, V.; Lu, J.; Niu, J.; Heon, M.; Hultman, L.; Gogotsi, Y.; Barsoum, M. W., Two Dimensional Nanocrystals Produced by Exfoliation of Ti_3AlC_2, ***Advanced Materials 2011***, 23 (37), 4248-4253. **[IF: 10.857]** ***Cover story and has been cited more than 15 times in one year.***
14. **Naguib, M.**; Presser, V.; Lane, N.; Tallman, D.; Gogotsi, Y.; Lu, J.; Hultman, L.; Barsoum, M.W., Synthesis of a New Nanocrystalline Titanium Aluminum Fluoride Phase by Reaction of Ti_2AlC with Hydrofluoric Acid, ***RSC Advances 2011***, 1 (8), 1493-1499. **[no IF yet]**
15. **Naguib, M.**; Presser, V.; Tallman, D.; Lu, J.; Hultman, L.; Gogotsi, Y.; Barsoum, M.W., On the Topotactic Transformation of Ti_2AlC into a Ti-C-O-F Cubic Phase by Heating in Molten Lithium Fluoride in Air, *Journal of the American Ceramic Society* ***2011***, 94 (12), 4556-4561. **[IF: 2.167]**

Conference Presentations and Posters

The presenter's name, if not me, is written in ***Bold Italic.***

1. **Naguib, M.**; Mashtalir, O; Barsoum, M. W.; ***Gogotsi, Y.***; Two-Dimensional Early Transition Metal Carbides and Carbonitrides (MXenes), **MRS Spring Meeting 2013**, San Francisco, CA, USA. **[Invited talk]**
2. ***Naguib, M.***; Dall'Agnese, Y; Mashtalir, O; Barsoum, M. W.; Simon, P.; Gogotsi, Y.; Two-Dimensional Transition Metal Carbides Anodes for Lithium Ion Batteries, **MRS Spring Meeting 2013**, San Francisco, CA, USA.

3. ***Naguib, M.***; Mashtalir, O; Dall'Agnese, Y; Barsoum, M. W.; Gogotsi, Y.; Two-Dimensional Titanium Carbide Based Material, **MRS Spring Meeting 2013**, San Francisco, CA, USA. (Poster)
4. ***Lukatskaya, M. R.***; Dall'Agnese, Y; **Naguib, M.**; Beidaghi, M.; Simon, P.; Barsoum, M. W.; Gogotsi, Y.; Capacitive Performance of Titanium Carbide Based MXenes, **MRS Spring Meeting 2013**, San Francisco, CA, USA. (Poster)
5. **Naguib, M.**; Mashtalir, O.; Kurtoglu, M..; Barsoum, M. W.; ***Gogotsi, Y.***; Manufacturing and Properties of 2-Dimensional Carbides and Carbonitrides (MXenes), **37th ICACC 2012**, Daytona Beach, FL, USA. **[Invited talk]**
6. **Naguib, M.**; Come, J.; Dall'Agnese, Y; Mashtalir, O; Taberna, P-L.; Simon, P.; Barsoum, M. W.; ***Gogotsi, Y.***; Two Dimensional Transition Metal Carbides and Carbonitrides (MXenes) Anodes for Lithium Ion Batteries and Lithium Ion Capacitors, **37th ICACC 2012**, Daytona Beach, FL, USA.
7. ***Naguib, M.***; Mashtalir, O.; Carle, J; Kurtoglu, M.; Presser, V.; Lu, J.; Hultman, L.; Gogotsi, Y.; Barsoum, M. W. MXenes- A New Family of Two Dimensional Materials: Transition Metal Carbides Produced by Exfoliation of the MAX Phases, **MS&T'12,** Pittsburg, PA, USA. [**40 minutes oral presentation**]
8. ***Naguib, M.***; Come, J.; Mashtalir, O; Presser, V.; Taberna, P-L.; Simon, P.; Barsoum, M. W.; Gogotsi, Y.; MXenes- A New Family of Two Dimensional Materials for Use in Lithium Ion Batteries and Lithium Ion Capacitors, **MS&T'12**, Pittsburg, PA, USA.
9. ***Naguib, M.***; Come, J.; Mashtalir, O; Taberna, P-L.; Simon, P.; Barsoum, M. W.; Gogotsi, Y.; Two-Dimensional Transition Metal Carbides and/or Nitrides as Anode Material in LIBs, **MRS Fall Meeting 2012**, Boston, MA. USA. (Poster).
10. **Naguib, M.**; Come, J.; Mashtalir, O; Presser, V.; Taberna, P-L.; Simon, P.; Barsoum, M. W.; ***Gogotsi, Y.***; MXenes- A New Family of Two Dimensional Transition Metal Carbides Used as Intercalation Compounds, **ECS PRIME 2012**, Honolulu, Hawaii.
11. ***Naguib, M.***; Mashtalir, O.; Carle, J; Kurtoglu, M.; Presser, V.; Lu, J.; Hultman, L.; Gogotsi, Y.; Barsoum, M. W. MXenes: A New Family of 2D Early Transition Metal Carbides Produced by Exfoliation of the MAX Phases, **244th ACS National Meeting 2012,** Philadelphia, PA, USA.
12. ***Naguib, M.***; Come, J.; Mashtalir, O.; Presser, V.; Taberna, P-L.; Simon, P.; Barsoum, M. W.; Gogotsi, Y., MXenes: A New Family of 2D Transition Metal Carbides for Use in Lithium Ion Batteries and Lithium Ion Capacitors, **244th ACS National Meeting 2012**, Philadelphia, PA, USA. (Poster)
13. ***Naguib, M.***; Come, J.; Dyatkin, B.; Taberna, P-L.; Simon, P.; Barsoum, M. W.; Gogotsi, Y.; MXenes: A New Family of Two Dimensional Materials for Use in Lithium Ion Batteries and Lithium Ion Capacitors, **54th Electronic Materials Conference (EMC2012)**, State College, PA, USA.
14. **Naguib, M.**; Mashtalir, O.; Kurtoglu, M.; Barsoum, M.W.; ***Gogotsi, Y.***; Two-dimensional Transition Metal Carbides Produced by Exfoliation of MAX Phases, **NSF/AFOSR Workshop on 2D Materials Beyond Graphene 2012,** Washington, DC, USA.
15. **Naguib, M.;** Mashtalir, O.; Barsoum, M.W.; ***Gogotsi, Y.***; Two-Dimensional Non-Oxide Ceramics, **NSF Workshop on Emerging Research in Ceramics, Carbon, Glasses and Composites 2012**, Washington, DC, USA
16. ***Naguib, M.***; M.; Gogotsi, Y.; Barsoum, M.W.; New Layered Nanolaminates for Use in Lithium Battery Anodes, **2012 U.S. Department of Energy (DOE) Hydrogen and Fuel Cells Program and Vehicle Technologies Program Annual Merit Review (AMR)**, Washington, DC, USA (Poster).

17. **Naguib, M.**; Mashtalir, O.; Kurtoglu, M.; Barsoum, M.W.; ***Gogotsi, Y.***; Two-Dimensional Nanocrystals of Transition Metal Carbides Produced by Exfoliation of MAX Phases, **3rd International Samsonov Conference 2012**, Kyiv, Ukraine.
18. ***Naguib, M.***; Kurtoglu, M.; Presser, V.; Lu, J.; Niu, J.; Heon, M.; Hultman, L.; Gogotsi, Y.; Barsoum, M. W. Two-Dimensional Nanocrystals of Ternary Transition Metal Carbides and Nitrides Produced by Exfoliation of MAX Phases, **MRS Fall Meeting 2011**, Boston, MA. USA. (Poster).

Filed Patent

U.S. Provisional Application #61/521,428; filed August 9, 2011
Title: Compositions Comprising Free Standing Two Dimensional Nanocrystals
Inventors: Michel Barsoum, **Michael Naguib Abdelmalak,** Yury Gogotsi

Honors and Awards

- **DAAD** (The German Academic Exchange Service) **Short Term Grant Scholarship**, for conducting research (from Nov. 4th 2012 to Jan. 29th 2013) at INM – Leibniz-Institut für Neue Materialien, Saarbrücken, **Germany**.
- **George Hill, Jr. Endowed Fellowship**, Drexel University, Spring 2012 ($6,000).
- People's choice award for *International Science & Engineering Visualization Challenge* from **NSF**, 2012. The award was highlighted in ***Science***, Vol. 335 pp. 526-527 (2012).
- **ECS Battery Division travel grant** for 2012 ECS/PRiME Honolulu (I declined due to conference time conflict with MS&T'12)
- Research featured by InsideScienceTV; sponsored by American Institute of Physics; "Nanomaterials for Energy Efficiency" August 30, 2012.
http://www.youtube.com/watch?v=-WQ28DJWhZk&feature=plcp
- Front page story in The Philadelphia Inquirer (February 13, 2012)
http://articles.philly.com/2012-02-13/news/31055104_1_materials-microscope-battery/2

- **Roland B. Snow Award** for Best of Show, and 1st place award in ceramographic competition of the **American Ceramic Society**; *Materials Science and Technology Conf. & Exhibition in Pittsburg*, PA, 2012.
- 1st place at the **Nano Today** cover competition Vol. 7, Issue 1, February 2012.
- Cover story for **Nanotech Insight,** Vol. 2, Issue 4, October 2011.
- Cover story for **Advanced Materials,** Vol. 23, Issue 37, August 2011.
- 1st place award (class 4 SEM) in the international metallographic contest of **International Metallographic Society**; *Microscopy and Microanalysis meeting in Nashville*, Tennessee, 2011.
- 2nd place award in the ceramographic competition of the **American Ceramic Society**; *Materials Science and Technology Conf. & Exhibition in Columbus*, Ohio, 2011.
- One 1st place (class 9 black and white) and one 2nd place (class 4 SEM) awards in the international metallographic contest of **International Metallographic Society**; *Microscopy and Microanalysis meeting in Nashville*, Tennessee, 2011.

Manuscript Reviewer

- Carbon, Materials Letters, Vacuum.

Professional Membership

- Materials Research Society (**MRS**; vice president of Drexel student chapter)
- The Electrochemical Society (**ECS**; vice president of Drexel student chapter)
- American Chemical Society (**ACS**)

Training Experience and Internships

- 05/2011: Research visit and training on the synthesis and characterization of LIBs, Group of **Prof. Patrice Simon** at the Université Paul Sabatier, Toulouse, France.
- 08/2006: Internship at **Schlumberger**, Ras Shuqer, Egypt and **Orascom Constructions Industries Co**, Cairo, Egypt.
- 07/2006: Internship at **Egyptian Aluminum Co.**, Nagaa Hammadi, Egypt.
- 07-08/2005: Internship at **Belayim Petroleum Company**, South Sinai, Egypt.
- 07/2005: Internship at **Egyptian Copper Works**, Alexandria, Egypt.
- 06/2005: Internship at **Central Metallurgical Research and Development Institute**, Helwan, Egypt.

Languages

- English (Excellent),
- Arabic (Mother Language)

Volunteer and Community Service

- Member of the Organizing Team of the 9th International MPM Engineering Conference, Cairo, Egypt (21-24 Feb. 2005).
- Member in the Academic Committee of ICED 2006, Cairo, Egypt (International Conference for Engineering Development).

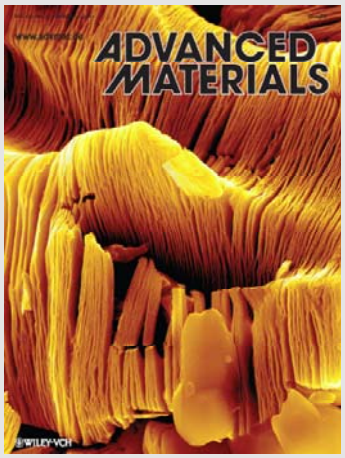
Personal Information

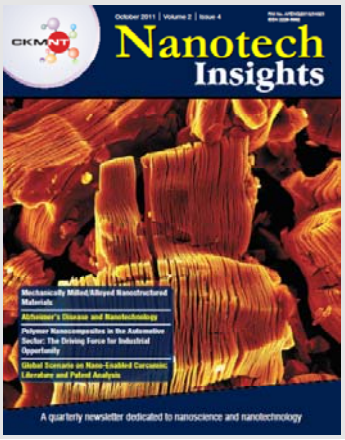
- Born: August 31, 1985; Married; Egyptian Citizien (on F-1 [studen] USA visa).

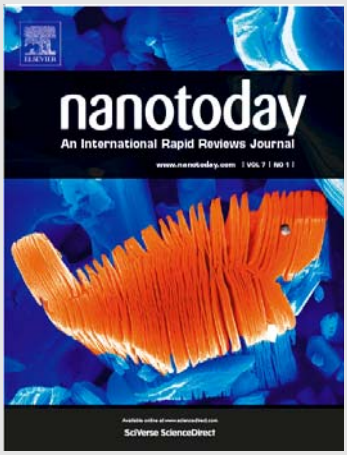
References

References are available upon request.

Cover Gallery







Science, 2012, Vol. 335, pp 526-527