



MATERIALS SCIENCE & ENGINEERING
UNIVERSITY of WASHINGTON

Scheduler (<https://www.instrumentschedule.com/fom/welcome?lid=0124>)
MyMSE (/mymse/)
Faculty Finder (<https://www.engr.washington.edu/faclookup/>)



UW

[ABOUT US](#) [PEOPLE](#) [RESEARCH](#) [NEWS & EVENTS](#) [ADMISSION](#) [STUDENTS](#) [COMMUNITY](#)

[GIVE](#) [♥](#) ([/GIVING](#))

PEOPLE

([http://](#))

[⬆](#) ([/](#)) [➤](#) [People \(/directory\)](#) [➤](#) [Core Faculty \(/people/faculty\)](#) [➤](#) [Guozhong Cao](#)

Guozhong Cao



Boeing-Steiner Professor of Materials Science & Engineering

Professor of Chemical Engineering
Adjunct Professor of Mechanical Engineering

302M Roberts Hall
206-616-9084
(Fax: 206-543-3100)
gzc@uw.edu (<mailto:gzc@uw.edu>)

Guozhong Cao Research
Group » (<http://depts.washington.edu/solgel/>)

Hel

Cc

(h

Er

(h

H

(h

U

(h

U

(h

Education

Ph.D., Eindhoven University of Technology, Eindhoven, the Netherlands
M.S., Chinese Academy of Sciences, Shanghai Institute of Ceramics, Shanghai, China
B.S., East China University of Science and Technology, Shanghai, China

Research Interests

Current research is focused mainly on chemical processing, characterization, and applications of nanostructured materials and coatings and devices for energy conversion and storage as well as sensors and actuators. In general, our research can be grouped into the following directions:

- Engineering nano and microstructures for excitonic solar cells: dye- and quantum dot-sensitized solar cells, inverted polymer solar cells and perovskite solar cells
- Design and controlled synthesis of nanostructured electrodes for rechargeable batteries: alkaline-ion batteries, metal-oxygen batteries, and flow batteries
- Electrodes for electric double layer capacitors and pseudocapacitors
- Dielectrics, ferroelectrics, and piezoelectrics and devices
- Template-based growth of nanorod, nanotube, and nanocable arrays
- Dielectrics, ferroelectrics, and piezoelectrics and devices
- Organic-inorganic hybrids and coatings for sensing, filtration, corrosion protection, and surface modification

Selected Recent Publications

COMPLETE LIST OF PUBLICATIONS ON GOOGLE SCHOLAR

Guozhong Cao and Ying Wang, "Nanostructures and Nanomaterials: Synthesis, Properties and Applications," 2nd edition, 596 pp, *World Scientific Publisher Co.*, Singapore, January 2011.

- Chinese Edition, 438 pp, *Higher Education Press*, Beijing, China, January 2012.
- Russian Edition, 515 pp. *Nauchy Mir Publishing House*, Russia, December 2012.

Glen E. Fryxell and **Guozhong Cao**, editors, "Environmental Applications of Nanomaterials: Synthesis, Sorbents and Sensors," 2nd edition, 735 pp, *Imperial College Press*, London, UK, 2012.

D.W. Liu and **G.Z. Cao**, "Engineering Nanostructures and Surface Chemistry of Electrodes for Efficient Lithium-ion Intercalation," *Energy and Environmental Science* **3**, 1218-1237 (2010).

K.S. Park, Q.F. Zhang, B.B. Garcia, Y.H. Jeong, and **G.Z. Cao**, "Effect of Ultra-thin TiO₂ Layer Coated on Submicron-sized Aggregates of ZnO Nanocrystallites by Atomic Layer Deposition (ALD) on the Performance of Dye-sensitized Solar Cells," *Advanced Materials* **22**, 2329-2332 (2010).

D.L. Lu, J.S. Cardiel, **G.Z. Cao**, and A.Q. Shen, "Nanoporous Scaffold with Enzymes Encapsulated during Flow Induced Gelation for H₂O₂ Biosensor," *Advanced Materials* **22**, 2809-2813 (2010).

Q.F. Zhang and **G.Z. Cao**, "Nanostructured Photoelectrodes for Dye-sensitized Solar Cells," *Nano Today* **6**, 91-109 (2011).

D.M. Yu, C.G. Chen, S.H. Xie, Y.Y. Liu, K.S. Park, X.Y. Zhou, Q.F. Zhang, J.Y. Li, and **G.Z. Cao**, "Mesoporous Vanadium Pentoxide Nanofibers with Significantly Enhanced Li-ion Storage Properties by Electrospinning," *Energy and Environmental Science* **4**, 858-861 (2011).

Y.Y. Liu, M. Clark, D.M. Yu, Q.F. Zhang, and **G.Z. Cao**, "Nanostructured Vanadium Pentoxide Film Electrodes for Efficient Lithium Ion Batteries," *Advanced Energy Materials* **1**, 194-202 (2011).

Q.F. Zhang and **G.Z. Cao**, "Dye-sensitized solar cells with photoanode made of nanoparticle aggregates," *Advanced Energy Materials* **1**, 988-1001 (2011).

S.L. Candelaria, R. Chen, Y.H. Jeong, and **G.Z. Cao**, "Highly porous chemically modified carbon cryogels and their coherent nanocomposites for energy applications," *Energy and Environmental Sciences* **5**, 5619-5637 (2012).

Z.Q. Liang, Q.F. Zhang, O. Wiranwetchayan, J.T. Xi, Z. Yang, K.S. Park, C.D. Li, and **G.Z. Cao**, "Effect of Morphology of ZnO Buffer Layer on Photovoltaic Performance of Inverted Polymer Solar Cells," *Advanced Functional Materials* **22**, 2194-2201 (2012).

L.F. Shen, X.G. Zhang, E. Uchaker, C.Z. Yuan, and **G.Z. Cao**, "Li₄Ti₅O₁₂ Nanoparticles Embedded in Mesoporous Carbon Matrix as a Superior Anode Material for High Rate Lithium Ion Batteries," *Advanced Energy Materials* **2**, 691-698 (2012).

S.L. Candelaria, Y.Y. Shao, Y. Zhou, X.L. Li, J. Xiao, J. Liu, J.H. Li, and **G.Z. Cao**, "Nanostructured carbon for energy conversion and storage applications," *Nano Energy* **1**, 195-220 (2012).

Z.S. Hong, X.K. Ding, T.B. Lan, M.D. Wei, and **G.Z. Cao**, "Additive-Free Synthesis of Unique Rutile TiO₂ Mesocrystals with Superior Lithium Insertion Performance," *Energy and Environmental Sciences* **5**, 5408-5413 (2012).

- L.F. Shen, K.B. Yin, E. Uchaker, C.Z. Yuan, Y.W. Li, X.G. Zhang, and **G.Z. Cao**, "Design and Tailoring of a Li₄Ti₅O₁₂/Carbon Core-Shell Nanostructure for High Power Lithium Ion Batteries," *Nano Letters* **12**, 5673-5678 (2012).
- L.F. Shen, E. Uchaker, X.G. Zhang, and **G.Z. Cao**, "Hydrogenated Li₄Ti₅O₁₂ Nanowire Arrays for High Rate Lithium Ion Batteries," *Advanced Materials* **24**, 6502-6506 (2012).
- Q.F. Zhang, S.L. Candelaria, E. Uchaker, and **G.Z. Cao**, "Nanostructured materials for energy conversion and storage," *Chemical Society Reviews* **42**, 3127-3171 (2013).
- M. Zhang, Y.W. Li, E. Uchaker, S.L. Candelaria, L.F. Shen, T.H. Wang, and **G.Z. Cao**, "Homogenous Incorporation of SnO₂ Nanoparticles into Carbon Cryogels via an Impregnation-Calcination Route and Their Enhanced Properties for Lithium-Ion Storage," *Nano Energy* **2**, 769-778 (2013).
- R. Gao, Z.Q. Liang, J.J. Tian, Q.F. Zhang, L.D. Wang, and **G.Z. Cao**, "ZnO Nanocrystallite Aggregates Synthesized through Interface Precipitation for Dye-sensitized Solar Cells," *Nano Energy* **2**, 40-48 (2013).
- J.J. Tian, Q.F. Zhang, E. Uchaker, S.G. Zhang, X.H. Qu, and **G.Z. Cao**, "Architecting mesoporous ZnO photoanodes for highly efficient quantum dot sensitized solar cells," *Energy and Environmental Sciences* **6**, 3542-3547 (2013).
- Y.W. Li, J.H. Yao, E. Uchaker, Z.G. Zou, Y.X. Huang, M. Zhang, and **G.Z. Cao**, "Leaf-like V₂O₅ Nanosheets Fabricated by a Facile Green Approach as High Energy Cathode Material for Rechargeable Lithium-ion Batteries," *Advanced Energy Materials* **3**, 1171-1175 (2013).
- L.F. Shen, B. Ding, X.G. Zhang, and **G.Z. Cao**, "Advanced Energy-Storage Architectures Composed of Lithium Metal Oxide Nanocrystal on Carbon Textiles," *Advanced Energy Materials* **3**, 1484-1489 (2013).
- E. Uchaker and **G.Z. Cao**, "Mesocrystals as electrodes for lithium ion batteries," *Nano Today* **9**, 499-524 (2014).
- C.B. Fei, J.J. Tian, Y.J. Wang, X.G. Liu, L.L. Lv, Z.X. Zhao, and **G.Z. Cao**, "Improved charge generation and collection in dye-sensitized solar cells with modified photoanode surface," *Nano Energy* **10**, 253-262 (2014).
- J.-L. Lan, Z.Q. Liang, Y.-H. Yang, F.S. Ohuchi, D.S. Ginger, S.A. Jenekhe, and **G.Z. Cao**, "The effect of SrTiO₃:ZnO as cathodic buffer layer for inverted polymer solar cells," *Nano Energy* **4**, 140-149 (2014).
- J. Wei, Q. Zhao, H. Li, C.L. Shi, J.J. Tian, **G.Z. Cao**, and D.P. Yu, "Perovskite solar cells: new promises of photovoltaics," *Science in China* **44**, 801-821 (2014).
- Y. Zhou, S.L. Candelaria, Q. Liu, Y.X. Huang, E. Uchaker, and **G.Z. Cao**, "Porous Carbon with High Capacitance and Graphitization through Controlled Removal of Sulfur-Containing Compounds," *Nano Energy* **12**, 567-577 (2015).
- S.Q. Liang, Y. Hu, A.Q. Pan, Z.W. Nie, H. Huang, T. Chen, and **G.Z. Cao**, "Template-Free Synthesis of Layer Stacked Ultra-Large V₂O₅ Nanosheets with Exceptional Small Thickness for High-Performance Lithium-Ion Batteries," *Nano Energy* **13**, 58-66 (2015).
- X. Pu, L.X. Li, H.Q. Song, C.H. Du, Z.F. Zhao, C.Y. Jiang, W.G. Hu, **G.Z. Cao**, and Z.L. Wang, "Self-charging power unit by integrating textile triboelectric nanogenerator and flexible lithium-ion battery for wearable electronics," *Advanced Materials* **27**, 2472-2478 (2015).
- C.K. Zhang, H.Q. Song, Y.G. Liu, C.P. Zhang, X.H. Nan, C.F. Liu, and **G.Z. Cao**, "High-rate core-shell Li₃VO₄/C anode for lithium-ion battery with a long cycling life," *Advanced Functional Materials* **25**, 3497-3504 (2015).
- J.J. Tian and **G.Z. Cao**, "Control of nanostructures and interfaces in quantum dots sensitized solar cells," *Journal of Physical Chemistry Letters* **6**, 1859-1869 (2015).

R. Masse, E. Uchaker, and **G.Z. Cao**, "Beyond Li-ion: Electrode Materials for Sodium- and Magnesium-ion Batteries," *Science China Materials* **58**, 715-766 (2015).

M. Zhang, T.H. Wang, and **G.Z. Cao**, "The promises and challenges of tin-based compounds as anode materials for lithium-ion batteries," *International Materials Reviews* **60**, 330-352 (2015).

Z.Q. Liang, Q.F. Zhang, L. Jiang, and **G.Z. Cao**, "Design and control of surface chemistry and morphology of ZnO cathode buffer layers for inverted polymer solar cells," *Energy and Environmental Science* **8**, 3442-3476 (2015).

L. Su, Z.X. Zhao, H.Y. Li, J. Yuan, **G.Z. Cao**, and G. Zhu, "High-Performance Organolead Halide Perovskite-Based Self-powered Triboelectric Photodetector," *ACS Nano* **9**, 11310-11316 (2015).

C.F. Liu, Z.G. Neale, and **G.Z. Cao**, "Understanding the electrochemical potential of electrodes in rechargeable batteries," *Materials Today*, online.

Professional Recognition and Honors

- 2015 Thomson Reuters Highly Cited Researcher in Materials Science
- 2014 Thomson Reuters Highly Cited Researcher in Materials Science
- University of Washington Presidential Entrepreneurial Faculty Fellow, UW, 2012
- Chaire Saint-Gobain Lectureship (invited professor), Ecole Polytechnique-CNRS, Paris, 2010
- Northwest Region Clean Tech Open Award, 2009
- Boeing-Steiner Endowed Professor of Engineering, University of Washington, 2008 – present
- University Distinguished Teaching Award, University of Washington, 2000
- College Outstanding Educator Award, College of Engineering, UW, 1999
- European Union Research Fellowship, Netherlands, 1993

Core Faculty (/people/faculty)

Contact Us

UW Department of Materials Science & Engineering

phone: (206) 543-2600

fax: (206) 543-3100

mse@u.washington.edu (mailto:mse@u.washington.edu)

(//engr.uw.edu)

(//www.washington.edu/boundless/)

Connect with us:

[UW Home](#) / [Contact Us](#) / [MyMSE](#) / [Log in](#) / [Resource Scheduler](#) / [Privacy](#) / [Terms](#)

[Learn about our ABET Accreditation \(/about/abet\)](#)

© 2017 UW Materials Science & Engineering | UW College of Engineering | Seattle, WA