Pratap M. Rao – Worcester Polytechnic Institute

Higgins Laboratories Room HL 106
100 Institute Road
Worcester Polytechnic Institute
Worcester, MA 01609

e-mail: pmrao@wpi.edu
Tel: (508) 831-4828
nanoenergy.wpi.edu

Appointments

Assistant Professor, Department of Mechanical Engineering 07/2013 - present

Worcester Polytechnic Institute, Worcester, MA

Education

Ph.D. in Mechanical Engineering 06/2013

Minor in Materials Science and Engineering

Stanford University, Stanford, CA

Dissertation: "Flame Synthesis and Applications of Metal Oxide Nanowires"

Advisor: Prof. Xiaolin Zheng

Committee: Prof. Xiaolin Zheng, Prof. R. E. Mitchell, Prof. Mark Cappelli, Prof. Bruce Clemens, Prof. T. F. Jaramillo

B.S. in Mechanical Engineering 05/2007

Worcester Polytechnic Institute (WPI), Worcester, MA

Peer-Reviewed Journal Publications

At WPI:

1. P. Allen, L. Cai, L. Zhou, C. Zhao and **P. M. Rao**, "Rapid Synthesis of Thin and Long $Mo_{17}O_{47}$ Nanowire-Arrays in an Oxygen Deficient Flame", ***Scientific Reports*** (accepted).
2. L. Zhou, C. Zhao, B. Giri, P. Allen, X. Xu, H. Joshi, Y. Fan, L. V. Titova, and **P. M. Rao**, "High Light Absorption and Charge Separation Efficiency at Low Applied Voltage from Sb-Doped SnO_2/$BiVO_4$ Core/Shell Nanorod-Array Photoanodes", ***Nano Letters***, DOI: 10.1021/acs.nanolett.5b05200, 2016.

Prior to WPI:

3. L. Cai, I. S. Cho, M. Logar, A. Mehta, J. He, C. H. Lee, **P. M. Rao**, Y. Feng, J. Wilcox, F. B. Prinz and X. Zheng, "Sol-flame synthesis of cobalt-doped TiO_2 nanowires with enhanced electrocatalytic activity for oxygen evolution reaction", ***Physical Chemistry Chemical Physics***, 16, 12299-12306, 2014.
4. **P. M. Rao**, L. Cai, C. Liu, I. S. Cho, C. H. Lee, J. M. Weisse, P. Yang and X. L. Zheng, "Simultaneously Efficient Light Absorption and Charge Separation in WO_3/$BiVO_4$ Core/Shell Nanowire Photoanode for Photoelectrochemical Water Oxidation", ***Nano Letters***, 14 (2), 1099–1105, 2014.

5. J. M. Weisse, C. H. Lee, D. R. Kim, L. Cai, **P. M. Rao**, and X. L. Zheng, "Electro-Assisted Transfer of Vertical Silicon Wire Arrays Using a Sacrificial Porous Silicon Layer", ***Nano Letters,*** 13 (9), 4362–4368 (2013).
6. R. Luo, I. S. Cho, Y. Feng, L. Cai, **P. M. Rao**, and X. L. Zheng, "Morphological control of heterostructured nanowires synthesized by sol-flame method", ***Nanoscale Research Letters,*** 8, 347, 2013.
7. I. S. Cho, C. H. Lee, Y. Feng, M. Logar, **P. M. Rao**, L. Cai, D.R.Kim, R. Sinclair and X. L. Zheng, "Codoping TiO_2 Nanowires with (W, C) for Enhancing Photoelectrochemical Performance", ***Nature Communications***, 4, 1723, 2013.
8. Y. Ohkura, **P. M. Rao**, I. S. Cho and X. Zheng "Reducing minimum flash ignition energy of Al microparticles by addition of WO_3 nanoparticles", ***Applied Physics Letters***, 102, 043108, 2013.
9. **P. M. Rao**, I. S. Cho and X. Zheng, "Flame Synthesis of WO_3 Nanotubes and Nanowires for Efficient Photoelectrochemical Water-Splitting", ***Proceedings of the Combustion Institute***, 34 (2), 2187–2195, 2013.
10. L. L. Cai, **P. M. Rao**, Y. Z. Feng and X. Zheng, "Flame Synthesis of 1-D Complex Metal Oxide Nanomaterials", ***Proceedings of the Combustion Institute***, 34 (2), 2229–2236, 2013.
11. Y. Z. Feng, I. S. Cho, L. L. Cai, **P. M. Rao and** X. Zheng, "Sol-Flame Synthesis of Hybrid Metal Oxide Nanowires", ***Proceedings of the Combustion Institute***, 34 (2), 2179–2186, 2013.
12. J. M. Weisse, A. M. Marconnet, D. R. Kim, **P. M. Rao**, M. A. Panzer, K. E. Goodson and X. L. Zheng, "Thermal Conductivity in Porous Silicon Nanowire Arrays", ***Nanoscale Research Letters***, 7:554, 2012.
13. Y. Z. Feng, I. S. Cho, **P. M. Rao**, L. L. Cai and X. Zheng, "Sol-Flame Synthesis: A General Strategy To Decorate Nanowires with Metal Oxide/Noble Metal Nanoparticles", ***Nano Letters***, 13 (3), 855-860, 2012.
14. Y. Ohkura, **P. M. Rao and** X. Zheng, "Flash ignition of Al nanoparticles: Mechanism and applications," ***Combustion and Flame***, 158 (12), 2544-2548, 2011.
15. I. S. Cho, Z. Chen, A. J. Forman, D. R. Kim, **P. M. Rao**, T. F. Jaramillo and X. Zheng, "Branched TiO_2 Nanorods for Photoelectrochemical Hydrogen Production," ***Nano Letters***, 11 (11), 4978-4984, 2011.
16. D. R. Kim, C. H. Lee, **P. M. Rao**, I. S. Cho and X. Zheng, "Hybrid Si Microwire and Planar Solar Cells: Passivation and Characterization," ***Nano Letters***, 11 (7), 2704-2708, 2011.
17. **P. M. Rao and** X. Zheng, "Unique Magnetic Properties of Single Crystal γ-Fe_2O_3 Nanowires Synthesized by Flame Vapor Deposition," ***Nano Letters***, 11 (6), 2390-2395, 2011.
18. L. L.Cai, **P. M. Rao and** X. Zheng, "Morphology-Controlled Flame Synthesis of Single, Branched, and Flower-like α-MoO_3 Nanobelt Arrays," ***Nano Letters***, 11 (2), 872-877, 2011.
19. **P. M. Rao and** X. Zheng, "Flame synthesis of tungsten oxide nanostructures on diverse substrates," ***Proceedings of the Combustion Institute***, 33 (2), 1891-1898, 2011.
20. Y. Z. Feng, **P. M. Rao**, D. R. Kim and X. Zheng, "Methane oxidation over catalytic copper oxide nanowires," ***Proceedings of the Combustion Institute***, 33 (2), 3169-3175, 2011
21. Y. Ohkura, S. Y. Liu, **P. M. Rao and** X. Zheng, "Synthesis and ignition of energetic CuO/Al core/shell nanowires," ***Proceedings of the Combustion Institut*e**, 33 (2), 1909-1915, 2011
22. **P. M. Rao and** X. Zheng, "Rapid Catalyst-Free Flame Synthesis of Dense, Aligned α-Fe_2O_3 Nanoflake and CuO Nanoneedle Arrays," ***Nano Letters***, 9 (8), 3001-3006, 2009.

Conference Presentations

1. "High Efficiency at Low Voltage from Sb-doped SnO_2/$BiVO_4$ Core/Shell Nanorod-Array Photoanodes", New England Catalysis Society (NECS) Spring Meeting, Brown University, 05/2016 (Oral)
2. "WO_3/$BiVO_4$ Core/Shell Nanowire Array as Efficient Water-Splitting Photoanode", New England Catalysis

Society (NECS) Fall Meeting, Worcester, MA, 11/2013 (Oral)

3. "$WO_3/BiVO_4$ Core/Shell Nanowire Array as Efficient Water-Splitting Photoanode", Materials Research Society (MRS) Spring Meeting, San Francisco, CA, 04/2013 (Oral)
4. "Rapid Flame Synthesis of Dense, Aligned, Single-crystal α-Fe_2O_3 Nanowire Arrays", Materials Research Society (MRS) Fall Meeting, Boston, MA, 11/2012 (Oral)
5. "Flame Synthesis of WO_3 Nanowires for Photoelectrochemical Water-splitting", MRS Fall Meeting, Boston, MA, 11/2012 (Oral)
6. "Flame synthesis of WO_3 nanotubes and nanowires for efficient photoelectrochemical water-splitting", 34th International Symposium on Combustion, Warsaw, Poland, 08/2012 (Oral)
7. "WO_3 Nanotubes for Effective Photoelectrochemical Water-splitting", Materials Research Society (MRS) Spring Meeting, San Francisco, CA, 04/2012 (Oral)
8. "Flame Synthesis and Applications of Metal Oxide Nanowires," MRS Fall Meeting, Boston, MA, 12/2011 (Oral)
9. "Magnetic Reversal of Flame-Synthesized Single Crystal γ-Fe_2O_3 Nanowires," MRS Fall Meeting, Boston, MA, 12/2011 (Poster)
10. "Flame Synthesis of Tungsten Oxide Nanostructures on Diverse Substrates," 33rd International Symposium on Combustion, Beijing, China, 08/2010 (Oral)
11. "Atmospheric, Catalyst-Free Flame Synthesis of Metal Oxide Nanowires," MRS Spring Meeting, San Francisco, CA, 04/2010 (Oral)
12. "Rapid Catalyst-Free Flame Synthesis of α-Fe_2O_3 Nanoflakes and CuO Nanoneedles," 6th U.S. National Combustion Meeting, Ann Arbor, MI, 05/2009 (Oral)
13. "Rapid Flame Synthesis of α-Fe_2O_3 Nanoneedle Arrays" MRS Spring Meeting, San Francisco, CA, 04/2009 (Poster)

Invited Talks

1. "Efficient and Scalable Solar Materials through Nanoscale Engineering and Flame Synthesis", Boston College, Department of Chemistry, March 19, 2015.
2. "Design and Scalable Synthesis of Nanoscale Composite Materials for Energy Conversion and Storage", Massachusetts Institute of Technology, Department of Chemical Engineering, Nov. 26, 2013.

Honors & Awards

Graduate Student Award Silver Medal (Materials Research Society)	12/2011
Energy Fellowship (Link Foundation)	07/2009 - 06/2011
Daniel W. MacDonald Memorial Fellowship (Stanford University)	09/2007 - 12/2008
Salisbury Prize (WPI)	05/2007
Tau Beta Pi Engineering Honor Society (WPI)	12/2005
Trustees' Scholarship (WPI)	08/2003 - 05/2007