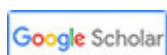


Staff information



Arun Devaraj

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Biography

Dr. Arun Devaraj is a Material scientist in the Physical and Computational Sciences Directorate. His research focus is in microstructure-property relationship of metallic alloys, oxides and composite materials. Dr. Devaraj has extensive experience specifically in applying atom probe tomography (APT) for material characterization, in addition to scanning electron microscopy (SEM), energy dispersive x-ray spectroscopy (EDS), focused ion beam (FIB), transmission electron microscopy (TEM), x-ray absorption near edge spectroscopy (XANES), scanning transmission x-ray microscopy (STXM) and in-situ high energy x-ray diffraction (HEXRD) at beamlines of various DOE synchrotron facilities.

Specifically Dr. Devaraj is interested in microstructure evolution in metallic alloys used in various structural applications ranging from automotive applications, nuclear materials and other energy related applications. He is also additionally focused on nanoscale characterization of Li/Na ion battery materials, catalysts, high strength natural biomaterials.

Research Interests

- Structure-property relationship of metallic alloys: Microstructural evolution, Thermodynamics and kinetics of Phase transformation, grain boundary segregation, precipitation, room temperature and elevated temperature mechanical property-microstructure correlation in bulk, surface and joints of materials, Influence of processing by thermo-mechanical treatments on microstructure, understanding effect of ion and neutron irradiation on material microstructure, correlating experimental results with atomic scale computational results from VASP DFT, or MD, montecarlo methods or FEM based theoretical calculations.
- Atom Probe Tomography: Application of APT for metallic alloys systems, pushing boundaries of application of APT especially for analyzing nanoscale composition of complex oxides, nanoparticles and porous materials used for variety of energy and environmental applications, APT-TEM- level set or FEM APT simulation correlation for understanding and correcting for aberrations in atom probe tomography reconstructions for complex materials. Development of APT for analysis of hard biological materials like teeth of different animals.
- Multimodal chemical imaging of energy materials by correlating APT analysis with variety of other characterization techniques including TEM, XAS, XRD, NMR and XPS.

Education and Credentials

- PhD Material science and engineering, University of North Texas, 2011
- B. Tech, Metallurgical engineering and Material Science, Malaviya National Institute of Technology, 2005
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Affiliations and Professional Service

- TMS
- MSA
- IFES
- MRS
- AVS

Awards and Recognitions

- 2016: Featured in PNNL director Steve Ashbys Column in Tri-city Herald titled " Making better 'stuff' at PNNL".
- 2016, 2015: Elected as leader for the Microscopy Society of America Atom Probe Tomography Focused Interest Group (MSA APT FIG).
- 2015: Featured in a News article titled "people behind science" in the local news paper "Tri-city Herald" as an upcoming young researcher in PNNL.
- 2016, 2015, 2014: lead organizer of Atom Probe Tomography focus topic symposium at 61st American Vacuum society national Meeting.
- 2015, 2014: People's choice winner of Science as Art 2014 and 2015 contest, Pacific Northwest National Laboratory.
- 2014: Selected to represent light weight vehicles materials research from EMSL at National User Facility Organization (NUFO) congressional science expo, June 10th 2014 at Rayburn Building, Washington DC.
- 2013: EMSL Directors award for creativity in research.
- 2013: Scientist and Engineer Development Program, PNNL 2013-2015
- 2013: Elected as leader-elect officer for the Microscopy Society of America Atom Probe Tomography Focused Interest Group (MSA APT FIG).
- 2011: Outstanding Leadership and Service Award by Department of Material science and engineering, University of North Texas
- 2010: Outstanding International Graduate student award by Robert Toulouse Graduate School, University of North Texas.
- 2008-2011: Elected Graduate Student Representative for the Department of material Science and Engineering, University of North Texas.
- 2008-2011: Elected President of Materials Advantage Chapter of University of North Texas
- 2006: Highest performance rating of "Benchmark to Employee performance" in the annual employee performance review in Essar Steel Ltd

PNNL Publications

2017

- Jana S, A Devaraj, L Kovarik, BW Arey, LE Sweet, T Varga, CA Lavender, and VV Joshi. 2017. "Kinetics of cellular transformation and competing precipitation mechanisms during sub-eutectoid annealing of U10Mo alloys." *Journal of Alloys and Compounds* 723:751-771. doi:10.1016/j.jallcom.2017.06.292
- Kovarik L, NM Washton, RK Kukkadapu, A Devaraj, A Wang, Y Wang, J Szanyi, CHF Peden, and F Gao. 2017. "Transformation of active sites in Fe/SSZ-13 SCR catalysts during hydrothermal aging: a spectroscopic, microscopic and kinetics study." *ACS Catalysis* 7(4):2458-2470. doi:10.1021/acscatal.6b03679
- Mohanty D, B Mazumder, A Devaraj, AS Sefat, A Huq, LA David, EA Payzant, J Li, DL Wood III, and C Daniel. 2017. "Resolving the degradation pathways in high-voltage oxides for high-energy-density lithium-ion batteries; Alternation in chemistry, composition and crystal structures." *Nano Energy* 36:76-84. doi:10.1016/j.nanoen.2017.04.008
- Shutthanandan V, S Choudhury, S Manandhar, TC Kaspar, CM Wang, A Devaraj, BD Wirth, S Thevuthasan, RG Hoagland, BP Uberuaga, and RJ Kurtz. 2017. "Radiation Tolerant Interfaces: Influence of Local

Stoichiometry at the Misfit Dislocation on Radiation Damage Resistance of Metal/Oxide Interfaces." *Advanced Materials Interfaces* 4(14):Article No. 1700037. doi:10.1002/admi.201700037

- Zang H, W Liu, T Li, C He, D Yun, W Jiang, A Devaraj, DJ Edwards, CH Henager, Jr, RJ Kurtz, and Z Wang. 2017. "VACANCY EFFECTS ON THE FORMATION OF HELIUM AND KRYPTON CAVITIES IN 3C-SiC IRRADIATED AND ANNEALED AT ELEVATED TEMPERATURES." Chapter 3.4 in *Fusion Materials Semiannual Progress Report For Period Ending December 31, 2016*, vol. DOE-ER-0313/61, ed. DI Clark, pp. 67-68. Oak Ridge National Laboratory, Oak Ridge, TN.

2016

- Devaraj A, L Kovarik, VV Joshi, S Jana, S Manandhar, BW Arey, and CA Lavender. 2016. *High-Resolution Characterization of UMo Alloy Microstructure*. PNNL-26020, Pacific Northwest National Laboratory, Richland, WA.
- Devaraj A, R Prabhakaran, VV Joshi, SY Hu, EJ McGarrah, and CA Lavender. 2016. *Theoretical Model for Volume Fraction of UC, 235U Enrichment, and Effective Density of Final U 10Mo Alloy*. PNNL-SA-117284, Pacific Northwest National Laboratory, Richland, WA.
- Devaraj A, S Jana, CA McInnis, NJ Lombardo, VV Joshi, LE Sweet, S Manandhar, and CA Lavender. 2016. *Detecting the Extent of Eutectoid Transformation in U-10Mo*. PNNL-SA-120714, Pacific Northwest National Laboratory, Richland, WA.
- Devaraj A, VV Joshi, A Srivastava, S Manandhar, VS Moxson, V Duz, and CA Lavender. 2016. "A Low-Cost Hierarchical Nanostructured Beta-Titanium Alloy with High Strength." *Nature Communications* 7:Article No. 11176. doi:10.1038/ncomms11176
- Wang CM, Z Zhu, MH Engelhard, A Devaraj, and DR Baer. 2016. "Multimodal and in-situ chemical imaging of critical surfaces and interfaces in Li batteries." *Microscopy Today* 24(2):32-39.
- Devaraj A, V Murugesan, J Bao, MF Guo, MA Derewinski, Z Xu, MJ Gray, S Proding, and KK Ramasamy. 2016. "Discerning the Location and Nature of Coke Deposition from Surface to Bulk of Spent Zeolite Catalysts." *Scientific Reports* 6:Article No. 37586. doi:10.1038/srep37586
- Leary A, V Keylin, A Devaraj, V DeGeorge, P Ohodnicki, and M McHenry. 2016. "Stress induced anisotropy in Co-rich magnetic nanocomposites for inductive applications." *Journal of Materials Research* 31(20):3089-3107. doi:10.1557/jmr.2016.324
- Li X, CT Ma, J Lu, A Devaraj, SR Spurgeon, RB Comes, and JS Poon. 2016. "Exchange bias and bistable magneto-resistance states in amorphous TbFeCo thin films." *Applied Physics Letters* 108:012401. doi:10.1063/1.4939240
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- Prabhakaran R, A Devaraj, VV Joshi, and CA Lavender. 2016. *Procedure for Uranium-Molybdenum Density Measurements and Porosity Determination*. PNNL-25793, Pacific Northwest National Laboratory, Richland, WA.
- Ramasamy KK, MJ Gray, HM Job, DM Santosa, XS Li, A Devaraj, AJ Karkamkar, and Y Wang. 2016. "Role of Calcination Temperature on the Hydrotalcite Derived MgO-Al₂O₃ in Converting Ethanol to Butanol." *Topics in Catalysis* 59(1):46-54. doi:10.1007/s11244-015-0504-8
- Roder PB, S Manandhar, A Devaraj, DE Perea, EJ Davis, and PJ Pauzauskie. 2016. "Pulsed Photothermal Heating of One-Dimensional Nanostructures." *Journal of Physical Chemistry C* 120(38):21730-21739. doi:10.1021/acs.jpcc.6b04592
- Shinde D, L Arnoldi, A Devaraj, and A Vella. 2016. "Laser-material interaction during atom probe tomography of oxides with embedded metal nanoparticles." *Journal of Applied Physics* 120(16):Article No. 164308. doi:10.1063/1.4966122
- Spurgeon SR, Y Du, TC Droubay, A Devaraj, X Sang, P Longo, P Yan, PG Kotula, V Shutthanandan, ME Bowden, JM LeBeau, CM Wang, P Sushko, and SA Chambers. 2016. "Competing Pathways for Nucleation of

the Double Perovskite Structure in the Epitaxial Synthesis of La₂MnNiO₆." *Chemistry of Materials* 28(11):3814-3822. doi:10.1021/acs.chemmater.6b00829

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- Wang S, M Sina, PA Parikh, T Uekert, B Shahbazian, A Devaraj, and YS Meng. 2016. "Role of 4-tert-Butylpyridine as a Hole Transport Layer Morphological Controller in Perovskite Solar Cells." *Nano Letters* 16(9):5594-5600. doi:10.1021/acs.nanolett.6b02158
- Zang H, W Jiang, W Liu, A Devaraj, DJ Edwards, CH Henager, Jr, RJ Kurtz, T Li, C He, D Yun, and Z Wang. 2016. "Vacancy effects on the formation of He and Kr cavities in 3C-SiC irradiated and annealed at elevated temperatures." *Nuclear Instruments and Methods in Physics Research. Section B, Beam Interactions with Materials and Atoms* 389-390:40-47. doi:10.1016/j.nimb.2016.11.017

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- Devaraj A, RJ Colby, F Vurpillot, and S Thevuthasan. 2014. "Understanding Atom Probe Tomography of Oxide-Supported Metal Nanoparticles by Correlation with Atomic Resolution Electron Microscopy and Field Evaporation Simulation." *Journal of Physical Chemistry Letters* 5(8):1361-1367. doi:10.1021/jz500259c
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- Perea DE, DK Schreiber, A Devaraj, S Thevuthasan, J Yoo, SA Dayeh, and ST Picraux. 2012. "Controlling Axial p-n Heterojunction Abruptness Through Catalyst Alloying in Vapor-Liquid-Solid Grown Semiconductor Nanowires." *Microscopy and Microanalysis* 18(Suppl. 2):1860-1861. doi:10.1017/S1431927612011154