



Exponent[®]
Engineering & Scientific Consulting

Pralav Shetty, Ph.D.

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Professional Profile

Dr. Shetty is a materials and mechanical engineer with expertise in advanced characterization of material failure in extreme environments. He has worked on components ranging from the small scale (2D materials) to the very large (refinery pipelines). His previous work includes the development of layered semiconductors, novel memory devices, corrosion and oxidation resistant alloys, ultralow-temperature batteries, and solid-state batteries. His research generates understanding on how challenging environments like corrosive fluids, extreme temperatures, radiation, and electrical bias induce material transformations. He uses a variety of ex/in situ and operando characterization techniques to understand how surfaces, interfaces, structure, chemistry, and the strength of materials evolve in operating conditions.

Dr. Shetty has extensive experience in characterizing materials for electronic devices and energy generation/storage using atomic force microscopy (AFM), x-ray photoelectron spectroscopy (XPS), optical microscopy and profilometry, scanning electron microscopy (SEM), focused ion beam (FIB), energy dispersive x-ray spectroscopy (EDS), x-ray diffraction (XRD), nanoindentation, and transmission electron microscopy (TEM/STEM). Additionally, he has designed custom experiments in optical microscopes, SEM, and TEM to observe material transformations as they occur and correlate this information across length-scales.

Prior to joining Exponent, Dr. Shetty was a Postdoctoral Fellow at Georgia Institute of Technology where he developed in situ and low dose imaging techniques to improve the characterization of 2D semiconductors and alkali metal batteries. Before working at Georgia Tech, he was a Graduate Research Assistant at University of Illinois at Urbana-Champaign where he developed corrosion resistant thin films and bulk metallic parts using microstructural and compositional control.

Academic Credentials & Professional Honors

Ph.D., Materials Science and Engineering, University of Illinois, Urbana-Champaign, 2019

B.S., Mechanical Engineering, Pennsylvania State University, 2013

FMC Educational Fund Fellowship, FMC Corporation, 2017-2018

Donald W. Hamer Fellowship, University of Illinois at Urbana-Champaign, 2014

Schreyer Scholars Medal, Pennsylvania State University, 2013

Prior Experience

Postdoctoral Fellow, Georgia Institute of Technology, 2019-2021

Consultant, Georgia Institute of Technology/Schneider Electric, 2021

Chair, Gordon Research Seminar, 2016-2018

RDE&Q Intern, Goodyear Tire and Rubber Company, 2012-2013

Languages

Hindi

Patents

US Patent 10,822,710: Aluminized metallic scaffold for high temperature applications and method of making an aluminized metallic scaffold, November 2020 (Braun PV, Zhang R, Krogstad JA, Angle JP, Shetty PP).

US Patent Application 16/460,050: Ferrous structural component for use in fouling and corrosive environments, and method of making and using a ferrous structural component, January 2020 (Krogstad JA, Braun PV, Shetty PP, Daryadel SS).

Publications

Lee C, Han SY, Lewis JA, Shetty PP, Yeh D, Liu Y, Klein E, Lee HW, McDowell MT. Stack Pressure Measurements to Probe the Evolution of the Lithium–Solid-State Electrolyte Interface. *ACS Energy Letters* 2021; 6:3261-9.

Lewis JA, Cortes FJ, Liu Y, Miers JC, Verma A, Vishnugopi BS, Tippens J, Prakash D, Marchese TS, Han SY, Lee C. Linking void and interphase evolution to electrochemistry in solid-state batteries using operando X-ray tomography. *Nature Materials* 2021; 20(4):503-10.

Thenuwara AC, Shetty PP, Kondekar N, Wang C, Li W, McDowell MT. Enabling highly reversible sodium metal cycling across a wide temperature range with dual-salt electrolytes. *Journal of Materials Chemistry A*. 2021; 9(17):10992-1000.

Kondekar N, Shetty PP, Wright SC, McDowell MT. In Situ Characterization of Transformations in Nanoscale Layered Metal Chalcogenide Materials: A Review. *ChemNanoMat*. 2021; 7(3):208-22.

Shetty PP, Kondekar N, Thenuwara AC, Boebinger MG, Wright SC, Tian M, McDowell MT. In Situ Dynamics during Heating of Copper-Intercalated Bismuth Telluride. *Matter*. 2020; 3(4):1246-62.

Valentino GM, Shetty PP, Chauhan A, Krogstad JA, Weihs TP, Hemker KJ. Nanotwin formation in Ni–Mo–W alloys deposited by dc magnetron sputtering. *Scripta Materialia*. 2020; 186:247-52.

Thenuwara AC, Shetty PP, Kondekar N, Sandoval SE, Cavallaro K, May R, Yang CT, Marbella LE, Qi Y,

McDowell MT. Efficient low-temperature cycling of lithium metal anodes by tailoring the solid-electrolyte interphase. *ACS Energy Letters*. 2020; 5(7):2411-20.

Valentino GM, Shetty PP, Krogstad JA, Hemker KJ. Fabrication of Freestanding Metallic Ni-Mo-W Microcantilever Beams With High Dimensional Stability. *Journal of Microelectromechanical Systems*. 2020; 29(3):329-37.

Han SY, Lewis JA, Shetty PP, Tippens J, Yeh D, Marchese TS, McDowell MT. Porous metals from chemical dealloying for solid-state battery anodes. *Chemistry of Materials*. 2020; 32(6):2461-9.

Mujica M, Tutuncuoglu G, Shetty PP, Mohabir AT, Woods EV, Breedveld V, Behrens SH, Filler MA. The Geode Process: Hollow Silica Microcapsules as a High Surface Area Substrate for Semiconductor Nanowire Growth. *ACS Applied Nano Materials*. 2019; 3(1):905-13.

Shetty PP, Daryadel S, Haire BT, Tucker ZR, Wu T, Subramani V, Morrison JJ, Quayle P, Yeates S, Braun PV, Krogstad JA. Low-temperature pack aluminization process on pipeline steel to inhibit asphaltene deposition. *ACS applied materials & interfaces*. 2019; 11(50):47596-605.

Thenuwara AC, Shetty PP, McDowell MT. Distinct nanoscale interphases and morphology of lithium metal electrodes operating at low temperatures. *Nano letters*. 2019; 19(12):8664-72.

Mohimi E, Zhang ZV, Mallek JL, Liu S, Trinh BB, Shetty PP, Girolami GS, Abelson JR. Low temperature chemical vapor deposition of superconducting vanadium nitride thin films. *Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films*. 2019; 37(3):031509.

Shetty PP, Zhang R, Haire BT, Smith CS, Kenny LM, Wu T, Subramani V, Morrison JJ, Quayle P, Yeates S, Braun PV. Effect of Surface Chemistry and Roughness on the High-Temperature Deposition of a Model Asphaltene. *Energy & Fuels*. 2019; 33(5):4104-14.

Shetty PP, Emigh MG, Krogstad JA. Coupled oxidation resistance and thermal stability in sputter deposited nanograined alloys. *Journal of Materials Research*. 2019; 34(1):48-57.

Oh J, Zhang R, Shetty PP, Krogstad JA, Braun PV, Miljkovic N. Thin film condensation on nanostructured surfaces. *Advanced Functional Materials*. 2018; 28(16):1707000.

Shetty PP, Zhang R, Angle JP, Braun PV, Krogstad JA. Pack Aluminization Assisted Enhancement of Thermo-mechanical Properties in Nickel Inverse Opal Structures. *Chemistry of Materials*. 2018; 30(5):1648-54.

Ma D, Hess DT, Shetty PP, Adu KW, Bell RC, Terrones M. Magnetic quenching of photonic activity in Fe₃O₄-elastomer composite. *Journal of Nanophotonics*. 2016; 10(1):016017.

Shetty PP, Hatton RW, Barnett AC, Homich AJ, Moore JZ. Modeling the cutting edge geometry of scalpel blades. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*. 2017; 231(1):65-72.

Presentations

Shetty PP, McDowell MT. In Situ Dynamics During Heating of Copper-Intercalated Bismuth Telluride using Electron Microscopy. Oral Presentation, MRS Fall Meeting, Virtual, 2021.

Sandoval SE, Klein EJ, Shetty PP, Thenuwara AC, Cavallaro KA, McDowell MT. The Effect of Temperature and SEI Formation on the Nucleation and Growth of Electrochemically Plated Lithium. Oral Presentation, PRiME – The Electrochemical Society, Virtual, 2020.

Shetty PP, McDowell MT. In Situ Investigation of Transformations in Copper-Intercalated. Bismuth Telluride. Oral Presentation, CNMS User Meeting, Virtual, 2020.

Daryadel S, Shetty PP, Subramani V, Braun PV, Krogstad JA. Mitigation of asphaltene deposition on pipeline alloy steel using low-temperature pack aluminization. Oral Presentation, TMS Annual Meeting & Exhibition, San Diego, CA, 2020.

Han S, Lewis JA, Shetty PP, Yeh D, Marchese TS, McDowell MT. Scalable porous metals from lithium alloys. Oral Presentation, ECS Meeting, Atlanta, GA, 2019.

Kondekar N, Boebinger MG, Tian M, Kirmani MH, Shetty PP, McDowell MT. Influence of metal dopants on MoS₂ crystallization investigated through in situ electron microscopy. Oral Presentation, ECS Meeting, Atlanta, GA, 2019.

Kondekar N, Boebinger MG, Tian M, Kirmani MH, Shetty PP, McDowell MT. The effect of Ni on MoS₂ crystallization and growth revealed with in situ TEM. Oral Presentation, EMC Meeting, Ann Arbor, Michigan, 2019.

Shetty PP, Subramani V, Braun PV, Krogstad JA. Characterizing high-temperature asphaltene fouling and corrosion of ferrous alloys. Oral presentation, TMS Annual Meeting & Exhibition, San Diego, CA, 2019.

Shetty PP, Emigh M, Krogstad JA. Mechanistic insights on the enhanced environmental stability of sputter deposited nanograined alloys. Oral presentation, TMS Annual Meeting & Exhibition, San Diego, CA, 2019.

Shetty PP, Zhang R, Subramani V, Braun PV, Krogstad JA. Mitigation of carbonaceous deposit formation on structural alloys via surface modification. Oral presentation, Materials Science & Technology, Columbus, OH, 2018.

Krogstad JA, Shetty PP. Planar defects in nanocrystalline metallic alloys: stability, transformation, and transport. Oral presentation, International Conference on the Strength of Materials, Columbus, OH, 2018.

Shetty PP, Krogstad JA. Enhanced oxidation resistance and thermal stability in sputter deposited nanograined alloys. Poster Presentation, Gordon Research Seminar, Lewiston, ME, 2018.

Shetty PP, Subramani V, Krogstad JA. Understanding the correlation between asphaltene deposition and corrosion of structural alloys. Poster Presentation, Petrophase, Park City, Utah, 2018.

Shetty PP, Krogstad JA. Effect of nanostructure and composition on the transient oxidation behavior of nanograined alloys. Oral Presentation, International Conference on Metallurgical Coatings and Thin Films, San Diego, CA, 2017.

Krogstad JA, Shetty PP. Influence of grain boundary transport on transient oxidation. Oral Presentation, TMS Annual Meeting & Exhibition, San Diego, CA, 2017.

Shetty PP, Krogstad JA. Mechanisms to control oxidation in nanograined metallic alloys. Oral Presentation, Gordon Research Seminar, Lewiston, ME, 2016.

Ma D, Shetty PP, Adu K, Rajagopalan R. Enhanced performance in flexible binder-free SWCNT membrane EDLC. Poster Presentation, APS March Meeting, Baltimore, MD, 2013.

Ma D, Hess D, Shetty PP, Bell R, Terrones M, Adu K. Magnetic quenching of plasmon-photonic activities in Fe₃O₄-elastomer composite. Poster Presentation, APS March Meeting, Baltimore, MD, 2013.

Ma D, Kalupson J, Shetty PP, Adu K, Rajagopalan R. Enhanced performance of symmetric double layer capacitor by flexible binder-free SWCNT membrane electrodes. Poster Presentation, MRS Spring Meeting, San Francisco, CA, 2013.

Ma D, Hess D, Shetty PP, Adu KW, Bell R, Terrones M. Polarized induced magnetic broadening of photonic activities in Fe₃O₄-elastomer composites. Poster Presentation, MRS Fall Meeting, Boston, MA, 2013.

Shetty PP, Kapulson J, Rajagopalan R, Adu K. Flexible single-wall carbon nanotube membrane symmetric aqueous double layer electrochemical capacitor. Oral Presentation, APS March Meeting, Boston, MA, 2012.

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