# SWAPNIL SURYAKANT SALVI

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Hands-on experimental experience in heat transfer measurements of li-ion cells, microelectronic packaging, and engineering materials. Solid technical understanding of thermal and fluid transport principles. Competent in thermal property measurement of solids/liquids and hands on skills of fabrication tools in the lab environment. Team player with leadership, project management and problem-solving skills. Proficient in verbal and written communication.

## TECHNICAL SKILLS

**3+ years of experience with Scientific Programming Tools:** MATLAB
**3+ years of experience with Finite Element/CFD Software:** COMSOL Multiphysics, ANSYS Fluent, ANSYS Icepak
**1+ years of experience with Experiment Design Software:** NI LabVIEW, MATLAB Simulink
**3+ years of experience with Mechanical Design Tools:** SolidWorks, Creo/ProE, AutoCAD
**2+ years of experience with Thermal Characterization Equipments:** Light Flash Apparatus (LFA), Transient Plane Source (TPS), Two thickness method (Fox50), Differential Scanning Calorimetry (DSC), Thermal Imaging / Infrared (IR) Camera
**6+ months of experience in Semiconductor Processing:** Microfabrication process development and specification, wafer processing (RCA cleanup), use of strong acids like HF and piranha, cleanroom device fabrication techniques, lithography manufacturing processes, rapid thermal anneal, surface resistance measurement, dry/wet etching, thin film chemical vapor deposition, sputtering, Lithography equipment – furnace oxidation, patterning techniques, Ellipsometry
**6+ months of experience in Data Analysis / Statistical Process Control Tools:** Excel, SAS, JMP, Minitab

## EDUCATION

**Ph.D. Mechanical Engineering** — **Expected – August 2022**
University of Texas at Arlington – Arlington, TX — *GPA: 4.00/4.00*
**Master of Technology, Mechanical Engineering** — **July 2016 - May 2018**
Indian Institute of Technology Ropar — *GPA: 3.46/4.00*
**Bachelor of Engineering, Mechanical Engineering** — **July 2013 - April 2016**
University of Mumbai — *GPA: 3.58/4.00*

## PROJECTS

**Thermal mapping of prismatic and cylindrical li-ion cells with fluorescent thermal imaging** — **December 2021 – Present**
- Designed a non-invasive fluorescent method for thermal mapping of li-ion cells using a digital camera.
- Detecting thermal performance in li-ion cell under various operational conditions, using a charge-discharge cycler.

**Analysis of li-ion battery pack with immersed cooling method focusing on accelerated cell aging** — **June 2021 – Present**
- Developed a physics-based thermal model for a lithium-ion battery pack equipped with immersed cooling thermal management system, focusing on thermal gradient across the cell.
- Conducted cell and module level experiments for validation of analytical thermal model.

**Measurement of tangential thermal conductivity of cylindrical-orthotropic Li-Ion cells** — **March 2020 – August 2021**
- Derived an analytical model focusing on the ratio of radial to tangential thermal conductivity.
- Strategically planned and designed the required experimental setup with radiating heat source.

**Fabrication of MOSCAP in a cleanroom environment using various IC fabrication processes** — **August 2019 – December 2019**
- Gained knowledge of basic limitations and challenges of new materials as well as 3D CMOS devices for lithography.
- Developed an understanding of the standard processes like Wafer Cleaning (RCA Cleanup), Thermal Oxidation, Ellipsometric measurements, Diffusion, Photolithography, Capacitance and Layer Resistance measurements, etc.

**Detection of unusual thermal activities in 3D-IC using Infrared Camera** — **August 2018 – March 2020**
- Designed a fixture and carried out experiments to detect unusual thermal activity in a multi-die integrated circuit packaging and recorded thermal signatures of the transistor plane using infrared camera.
- Carried out image processing using various machine learning algorithms such as Structural Similarity Index Method (SSIM), 2D Correlation Coefficient Method, etc. to detect anomalous thermal activity on the chip.
- Analyzed trade-offs in detection accuracy and speeds, as well as false positives and negatives.

**Thermal conductivity measurement of thin wires using the fin effect** — **August 2018 – October 2019**
- Designed an experiment to measure the thermal conductivity for different wires of similar/dissimilar diameters.

- Derived a model for thermal conductivity measurement based on the theory of heat transfer in extended surfaces.
- Measured infrared thermal distribution data and validated the experimental data with analytical model using MATLAB.

## RELEVANT GRADUATE-LEVEL COURSEWORK

Design of Experiments (DOE), Silicon IC Fabrication Technology, Advanced Metal Additive Manufacturing, Convection Heat Transfer, Thermal Conduction, Advanced Classical Thermodynamics, Fluid Dynamics, Analytical Methods in Engineering

## PROFESSIONAL WORK EXPERIENCE

***Student Engineer*** **June2021 - August 2021**

**Electrified Powertrain, Southwest Research Institute**

- Developed an analytical heat transfer model of a lithium-ion battery pack focusing on thermal gradient across the cell.
- Conducted cell and module-level experiments as well as data analysis for a customized thermal management system.
- Design, manufacturing, and validation of a specialized test rig focusing on the immersed cooling as well as core temperature measurement for a 21700 Li-ion 7PS1 Brick.

***Research Assistantship*** **August 2018 - Present**

**Microscale Thermophysics Laboratory, The University of Texas at Arlington**

- Designed VIs in LabVIEW using National Instruments Data Acquisition (NI DAQ) Systems to collect the high-frequency experimental data (voltage fluctuations, temperature readings, heat flux data, serial communication, etc.)
- Experienced in operating and responsible for maintaining the lab equipments - Light Flash Apparatus (LFA), Transient Plane Source (TPS), Two thickness method (Fox50), Differential Scanning Calorimetry (DSC).
- Experienced in thermal imaging using Infrared (IR) camera customized with various IR-Optical tools.
- Capable of conducting design and analysis of multi-factor experiments (Design of Experiments – DOE).
- Designed and developed customizations to an FDM equipment to characterize the thermal/structural aspects of printing.
- Experienced in hands on skills of fabrication tools as well as performing inspections in the lab environment (Polymer 3D Printer, EOS M290 Metal 3D Printer, Vacuum Drying Oven, Fume Hood, Glovebox, etc.).

## PUBLICATIONS

- **Salvi, S. S.**, Karam, P., Jain, A., "Thermal mapping of Li-Ion cells using Fluorescent Thermal Imaging", *[In preparation].*
- **Salvi, S. S.**, Jain, A., "Numerical Computation of Non-Linear Dual Drug Delivery and Binding", *[In preparation].*
- Ravoori, D., **Salvi, S. S.**, Prajapati, H., Jain, A., "Systems and Methods for Void Reduction in Additive Manufacturing", U.S. Patent: 17/530,858 [*In process*].
- **Salvi, S. S.**, Surampudi, B., Swarts, A., Alger, T., Sarlashkar, J., Smith, I., Jain, A., "Experimental and Theoretical Analysis of Immersion Cooling of a Li-Ion Battery Module and the Impact on Accelerated Cell Aging", *[Under review].*
- **Salvi, S. S.**, Jain, A., "A Review of Recent Research on Heat Transfer in Three-Dimensional Integrated Circuits (3D ICs)", *IEEE Transactions on Components, Packaging and Manufacturing Technology*, Vol. 11(5), pp. 802-821, 2021. [PDF]
- Prajapati, H.[1], **Salvi, S. S.**[1], Ravoori, D., Jain, A., "Improved in print quality in Fused Filament Fabrication through Localized Dispensing of Hot Air around the Deposited Filament", *Additive Manufacturing*, 40, pp. 101917:1-9, 2021. [PDF] ([1]**: equal contribution**)
- Ravoori, D., **Salvi, S. S.**, Prajapati, H., Qasaimeh, M., Adnan, A., Jain, A., "Void Reduction in Fused Filament Fabrication (FFF) through in situ Nozzle-Integrated Compression Rolling of Deposited Filaments", *Virtual and Physical Prototyping*, 16(2), pp. 146-159, 2021. [PDF]
- Prajapati, H., **Salvi, S. S.**, Ravoori, D., Jain, A., "Measurement of the in-plane temperature field on the build plate during polymer extrusion additive manufacturing using infrared thermometry", *Polymer Testing*, 92, p. 106866, 2020. [PDF]
- **Salvi, S. S.**, Jain, A., "Measurement of thermal conductivity of millimeter-sized wires using the fin effect", *Applied Thermal Engineering*, 177, pp. 2020. [PDF]
- **Salvi, S. S.**, Jain, A., "Detection of unusual thermal activities in a semiconductor chip using backside infrared thermal imaging", *ASME Journal of Electronic Packaging*, Vol. 143(2), pp. 020901:1-8, 2021. [PDF]
- **Salvi, S. S.**, Bhalla, V., Taylor, R. A., Khullar, V., Otanicar, T. O., Phelan, P. E., and Tyagi, H., "Technological Advances to Maximize Solar Collector Energy Output: A Review", *ASME Journal of Electronic Packaging*, Vol. 140(4), p. 040802. [PDF]

## ACCOMPLISHMENTS

- Doctoral Dissertation Fellowship – Summer 2022 (June 2022 – August 2022).
- Mechanical and Aerospace Engineering STEM fellowship (August 2018 – May 2022).
- NSF Supplemental Funding: Non-Academic Research Internships for Graduate Students (May 2021 – August 2021).