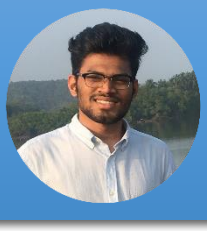

SAURABH PARAB

Program Materials Science and Engineering
Degree Doctor of Philosophy
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PhD student with extensive experience in applying chemical and physical insights. Develops pioneering strategies for solving both science and engineering problems, including approaches to optimize the synthesis procedure, improve the durability of electrodes, and increase battery performance. Core strengths also include theoretical understanding and hands-on experience in different material characterization techniques. Like travelling, cycling, movie-making, and design. Amateur Guitarist.

EDUCATION

Examination/Degree	*University*	*Institute*	*Year*	*CPI / %*
Ph.D	UC San Diego	UC San Diego	Ongoing	N/A
B. Tech + M. Tech	IIT Bombay	IIT Bombay	2020	8.04/10
Intermediate/+2	Maharashtra State Board (HSC)	PACE, Junior Science College, Andheri	2015	90.92 %
Matriculation	Maharashtra State Board (SSC)	Milagris High School	2013	97.27 %

RESEARCH EXPERIENCE

Development of High Specific Capacity Novel Cathode Material for Sodium-Ion Batteries [Mar'19 – Jun'20]

Master's Thesis ***(Grade: 9.17/10)*** *| Guide – Prof. Sagar Mitra | The Electrochemical Energy Laboratory, DESE, IIT Bombay*

❖ **Aim**

- To work towards commercialization of the Na-ion battery technology (**NMTN - NTO pouch cell fabrication**)
- To design a **low-cost and scalable synthesis method for** large scale manufacturing of the cathode materials
- To address the problems in $Na_{0.67}Mn_{0.67}Ni_{0.33}O_2$ material such as low capacity, low rate capability, & bad cycling stability
- Synthesizing **the novel material** by doping an inactive transition element having a compatible ionic radius and different Fermi level than Mn into $Na_{0.67}Mn_{0.67}Ni_{0.33}O_2$ (NMN) to suppress the charge ordering and Na+/vacancy ordering
- Analyzing the structural parameters by performing **Rietveld refinement** using the FullProf program

❖ **Work to be reported**

- Reproduced the pure phase of previously published $Na_{0.67}Mn_{0.50}Ti_{0.17}Ni_{0.33}O_2$ (NMTN) materials through a modified synthesis process by changing the precursors to **reduce the energy requirements**
- Devised a **simple, cost-effective and scalable synthesis approach** to reduce the NiO impurity problem in $Na_{0.67}Mn_{0.67}Ni_{0.33}O_2$ (NMN) through **Microwave-Assisted Sintering**

Development of Layered Oxide Cathode Material for Sodium-Ion Batteries [Oct'18 - Dec'18]

Research Internship | Guide – Prof. Do Kyung Kim | Nano Ceramics Research Lab, MSE, KAIST, South Korea

- Investigated the effect of **potassium doping/substitution** on the structural, morphological and electrochemical properties of P2-type layered oxide cathode material **$Na_{0.67-x}K_xFe_{0.5}Mn_{0.5}O_2$ for x=0, 0.05, 0.1, 0.2, 0.67**
- Gained **hands-on experience** on High-Resolution Powder X-Ray Diffractometer facility provided by KAIST Analysis Centre for Research Advancement (KARA); Analyzed the data by PDXL: Integrated X-ray powder diffraction software
- Confirmed the enlargement of the inter slab distances due to the substitution of K-ions; the cell parameters along c-axes calculated using Bragg's law were increased with increasing K-ion content
- Confirmed the **Uniform Particle Size** of 5 µm through SEM giving the optimum specific capacity of 200 mAh/g
- Mastered the process of making electrodes through the tape casting method and final cell assembly in the Glove Box
- Achieved a **stable performance for the undoped sample,** but drastic capacity fading was observed within ten cycles for the doped samples. Confirmed the inactivity of Mn and Fe through CV curve

Analyzing the contrast properties of Silica and Alumina Crucibles through Characterization [May'17 - Jun'17]

Research Internship | Guide – Prof. Parag Bhargava | Particulate Materials Lab, MEMS, IIT BOMBAY

- Analyzed the physical properties of ceramic samples through different techniques and state-of-art facilities

- **Structural analysis** of the powdered samples done **through XRD** showed strong peak-match with the pure phase for Alumina. Crystallinity is one of the reasons behind its high thermal expansion coefficient.
- **Morphological study by SEM** showed Alumina having cube-shaped particles while Silica particles were spherical
- Calculated the weighted percentage by **elemental analysis through ICP-AES** to find the present impurities
- Silica has excellent **thermal shock resistance** because of the bad thermal conductivity due to its amorphous nature

COURSE PROJECTS

Lithography Techniques for Semiconductor Patterning [Jan'19 - Apr'19]

Course Project | Guide – Prof. Dipti Gupta | Plastic Electronics and Energy Lab, MEMS, IIT Bombay

- Compared to different conventional & evolving lithographic technology based on min. feature size, technology, accuracy, etc.
- Consolidated latest industrial inventions like **Samsung's next-generation 5nm EUV technology** in the report
- Discussed the upcoming technologies to fulfill **Moore's law** predictions for the **next ten years** & the challenges involved in it

Mechanical Modelling of Malaria Virus-Infected Red Blood Cells [Jan'17 - Apr'17]

Term Paper | Guide – Prof. Aparna Singh | Nano Engineering Lab, MEMS, IIT BOMBAY

- Studied the life cycle of malaria-infected human blood cells and different transition phases through a literature survey
- Analyzed mechanical properties of RBC in **Poiseuille flow** like **viscosity, stiffness, stresses, and strains** in membrane
- Used the **Neo-Hookean Model** to explain the variation in parameters like shape & elasticity of the cell before it breaks
- Analyzed the mechanical system and plotted the **Pressure-Extension Ratio** for the human cell to describe the representative mathematical model

Study of Commercially Used Artistic Pencils [Jan'17 - Apr'17]

Course Project | Guide – Prof. Parag Bhargava | Particulate Materials Lab, MEMS, IIT BOMBAY

- Determined the possible molecules and chemical bonds present in the pencil tip by analyzing the **FTIR** data
- By elemental analysis found the impurity atoms which were present in the sample using **SEM-EDX**
- Found that **Graphite and Clay** were the major constituents present in all seven different samples and percentage of **C & SiO_2** were primary factors to differentiate between the pencils.
- Deduced an inverse relation between **Hardness (H) & Blackness (B)** based on the amount of C & SiO_2 present

Analysis of Accidental Deaths in India [Jul'16 - Nov'16]

Term Paper | Guide – Prof. Shobha Shukla | Nanostructures Engineering & Modeling Lab, MEMS, IIT BOMBAY

- Analyzed the number of accidental deaths & their causes (2002-14) based on data collected from various gov. sources
- Highlighted the main cause, i.e., Road accidents by analyzing the data through various perspectives, e.g., sex, age, year, etc.
- Represented the data & facts graphically by using Origin Pro & presented a paper based on the research work in standard **IEEE format**

SEMINARS

Manufacturing of Batteries [Oct'19]

Seminar | Guides – Prof. Avradeep Pal and Prof. Mithun Chowdhury | MEMS, IIT Bombay

- Visited **semi-commercial IIT Bombay - Monash battery prototyping laboratory** to understand the whole process
- Covered the working principle of batteries, different components, commercially used materials, construction of cell, instrumentation, and automation involved, and battery testing and safety precautions in the seminar presentation
- Explained the seven stepped process through representative videos: slurry preparation, tape casting, calendaring, cutting electrodes, cell assembly, electrode filling, and vacuum sealing

Characterization of Coatings using Surface Analytical Methods [Apr'18]

Seminar | Guide – Prof. Anand S. Khanna | Department of Metallurgical Engineering and Materials Science, IIT Bombay

- Explained the effect of enhancement in mechanical & thermal properties of matrix by **B_4C coating to diamond particles**
- Compared the results obtained by SEM, XRD, XPS, & Raman Spectroscopy to understand the role of coatings, various **interfacial phenomenon and boding mechanisms**
- Constructed a report to illustrate the current scenario of rapidly growing coating technology & industrial requirements

TEACHING EXPERIENCE

Teaching Assistant | Thermodynamics of Materials Course | IIT Bombay [Jul'19 – Nov'19]

The responsibilities included conducting weekly tutorials for second-year students that involved solving problem sheets and designing examples that demonstrated concepts covered in class. It also involved grading papers and assignments.

TECHNICAL SKILLS

Programming Skills	C++, Python, R, LaTeX
Software Skills	HighScore Plus | FullProf | MATLAB | Origin 8 Pro | SolidWorks | AutoCAD

SCHOLASTIC ACHIEVEMENTS

- **All India Rank 75** in Graduate Aptitude Test in Engineering (GATE) 2018-19 - Metallurgical Engineering
- **Silver Medalist** in **Homi Bhabha Junior Scientist Exam 2012** in Std. IX held by Greater Bombay Science Teachers Asso.
- Qualified for the **Scholarship for Higher Education'15** (SHE) under Innovation in Science Pursuit for Inspired Research (INSPIRE) by virtue of performance within top 1% of the School Board at Class XII level

INTERNSHIP EXPERIENCE

Digital Marketing Analyst | Fintelligence Data Science Private Limited [May'18 - Jun'18]

*Awarded **Letter of Recommendation** from the Chief Executive Officer for remarkable accomplishment during the internship*

- Created and executed **R Programme code** for plotting real-time customer location by integrating **Google Maps API**
- Composed 3 blogs mainly on **online Peer-to-Peer (P2P) Lending** as an upcoming investment strategy in Indian Economy
- Introduced and customized the **Referral Program** for the firm for developing the Referral Marketing strategy
- Prepared a comprehensive policy to improve the **Page & Domain authority** by integrating Newspaper Mentions
- Developed on-site body content, meta descriptions, and page titles as a part of **Search Engine Optimiz. strategy**
- Designed a **Newsletter** and created content through extensive research and data collection for the same for the month
- Employed **Google Analytics & Adwords** to increase relevant click-through & conversion rates for different social media ads

POSITIONS OF RESPONSIBILITY

Core Team Member, Creatives | Abhyuday, The Social Body of IIT Bombay [Apr'17 - Apr'18]

*Spearheaded 2 tier team of **10+ coordinators and 20+ organizers** in the task of website design, graphic design, and publicity*

Social Festival 2018	• Planned three national-level events and first of its kind **"Concert for a Cause"** with an audience of **2000+** • Increased fest footfall by **60%;** created quality content for social media pages catering to over **15,000 youths** • Achieved **71% y-o-y** increase in the no. of viewers by collaborating with the Web Team to design the official website • Organized an awareness session on the environmental situation in Mumbai and the effects of **Climate Change**
Initiatives	• Conceptualized & executed an interactive exhibition **Mills to Malls (Massive transformation of Mumbai)** • As a part of **Social Initiative, "Sparks to Fire"** created the concept featuring video to raise monetary funds
Career Counselling Campaign	• Managed the CCC Campaigns – **5000+ students from 29 schools PAN India have been counseled** till now • Spearheaded the designing and creation of Career Counseling booklets for the under-privileged students • Created video featuring **Abhyuday Helpline App** designed for the volunteers offering free career counseling

Design Secretary | Metallurgical Engineering and Material Science Department, IIT Bombay [May'16 - May'17]

Designed the **official logo of MMA & DHATUKI '16, the department newsletter**, in collaboration with **Insight, IIT Bombay**

Design and Fine Arts Secretary | Hostel 8, IIT Bombay [Sep'16 - Apr'17]

Secured **3rd position** in the institute level **Inter Hostel Design General Championship** organized by Institute Cultural Body

EXTRACURRICULAR

- Awarded with **Gold Medal** & **Certificate** for completing **633 km Cross Country Bicycle Path in 6 days** in **South Korea**
- Secured **A grade** in Elementary Grade Drawing Examination - 2011 organized by Art Examination Committee Maharashtra

REFERENCES

Prof. Sagar Mitra | Email: sagar.mitra@iitb.ac.in

The Electrochemical Energy Laboratory, Department of Energy Science and Engineering, IIT Bombay, India

Prof. Do Kyung Kim | Email: dkkim@kaist.ac.kr

Nano Ceramics Research Lab, Department of Materials Science and Engineering, *KAIST, South Korea*

Prof. Parag Bhargava | Email: pbhargava@iitb.ac.in

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