

Statement of Purpose

of

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(Ph.D. applicant Fall 2021)

What is research? What do you understand by research? Why do you want to do the research? What will you do something beneficial if you are doing research? These are some essential questions that arise frequently if someone is involved in a research field. For me, Research is all about bringing innovations and recent advances in a particular field. Research is a different world in which you get a chance to encounter the problems and necessities of current situations. After doing a research project recently, I experienced a thrilling journey to present my ideas and how deep you can think to find a solution to a particular problem. I understood that research is more about failures. You can not succeed only after performing one or two experiments but surely you can get your desired result after attempting several failures because you understand what you are doing wrong and what should you do next to get improved results. In the world of research, you are never alone. There will be people who will be there to help you, to suggest ideas, to share their experiences with you, and also to question your hypothesis. You just need to ask questions and help will be always there. In my case, I was surrounded by 3-4 Ph.D. research scholars and it was an enthralling experience to work with them. Over the passing time, I have found an inclination towards research, which has motivated me to consider research as a career and I believe doing a Ph.D. is the next important step right now.

I have done my **B.Tech in Mechanical Engineering from RKGIT Ghaziabad** in 2018 and my thesis project was based on designing and fabricating the tilting trike which was based on an independent suspension system. This was the first experience when I got the opportunity to feature in a practical world. This project mainly included two portions: Design and Fabrication. The design was done on the SolidWorks software. Parts used in tilted trike were made on different machines like lathe machine, Milling Machine, Drilling Machine, Grinding Machine, Bending Machine. All the parameters and dimensions were taken from the design. After finalizing the parameters and specifications of every part, fabrication was completely done by the application of a different machine. Every part has its different material property. Material properties are very important to know before its application. So parts were fabricated strictly according to mechanical and chemical properties. The engine type used in the trike was 109cc air-cooled single-cylinder four-stroke. Bore and stroke (50 mm \times 55.6 mm), compression ratio 9:1, two-valve train, 13mm piston-valve carburetor, etc. were used as engine specifications. Drive train, chassis, front and rear suspension, front and rear drum brakes, and front and rear tires were used as the extra parts in building the trike. This was a fascinating project which taught me to apply your theoretical knowledge to practicality.

When I was in my final semester and was doing this project, I was placed in a design company where I worked on few projects which gave me the industrial experience to handle the pressure

and maintain the various workload that I was facing at that time. I joined the company in April 2018 and started working as a design engineer trainee for 6 months. This was the time when I was managing my trike project as well but still, I came out as a winner after successfully defending my thesis for the final year project. After completing the degree, I focussed on projects which were handover to me. These projects were based on designing the primary layout of heat exchangers and boilers on AutoCAD software. This was the time when I realize for the first time that I am made for the research because I gained some serious interest in understanding things broadly. So I decided to go for higher education and joined **IIT Indore for M.Tech in Materials Science and engineering in July 2019.**

My M.Tech project work has been a roller coaster ride for me because my work got interrupted due to Covid-19 Pandemic and again when I got the chance to return to campus in February and joined the lab in March, I have been successful in completing my 90 % of work till now. I joined the NEMG(Nanomaterials and energy devices group) lab, IIT Indore under the supervision of Dr. Ajay Kr. Kushwaha. I started doing a literature survey on “Gallium oxide thin films and applications” and tried to know the basic principles behind depositing the gallium oxide films by various methods. Soon I realized that electrochemical deposition is a very less explored technique in the deposition of gallium oxide films. So I decided to work on this technique and reviewed its literature to find out the utility of outstanding properties of gallium oxide in the energy device application. Although gallium oxide has been known for decades it remained on the periphery of mainstream research. Gallium oxide scientific and technological research has greatly intensified over the last decade as the potential of Ga_2O_3 as the perspective wide bandgap semiconductor has been recognized. Recently when I rejoined the lab, I started my experimental research and worked according to my plan to perform electrodeposition for gallium oxide films on FTO substrates. I prepared a suitable electrolyte (Gallium chloride + DI water + Ammonia water) and used a three-electrode setup for deposition using an Autolab potentiometer by varying the potentials and deposition time after fixing a particular current density. I got favourable results when I investigate the samples by XRD & SEM and confirms the presence of GaOOH & Ga_2O_3 . I prepared many samples by annealing the as-prepared samples for phase crystallization. Right now I am making a Memristor device using those samples and IV simulations on MATLAB software using codes. I will submit my thesis by the end of next month, May.

Why IIT KGP-University of Manchester PhD Programme ?

Dual Awarded Ph.D. will provide me an opportunity to apply my knowledge in the research field of both the universities. I am looking forward to making a meaningful contribution to the ongoing research developments and live up to the high standards expected off the IIT Kharagpur & University of Manchester. It will be a great opportunity for me to join such a centre and work in the domain of allotted project.

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Signature with Name

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