

Statement of Purpose

I got interested in the domain of fluidics, particularly at smaller scale (micro and nano), when I took the elective course of “microscale transport phenomena” in the first semester of my Masters’ program in Chemical Engineering at IIT Kharagpur. A number of relevant concepts in microfabrication e.g., top down and bottom-up approach were introduced as well as techniques such as photo-lithography, sputtering, chemical vapour deposition and soft lithography, especially for creating micro-channels of various sizes and shapes. These concepts, especially the effect of length scale and the interplay of pertinent forces in the ensuing applications have intrigued me and I have decided to work in the exciting area of microfluidics and microflows.

Currently I am working in the Microfluidics Laboratory at the Chemical Engineering Department at IIT Kharagpur under the guidance of Prof. Sunando DasGupta. My work involves probing the physics of the effect of external force field on protein aggregation, both experimentally and theoretically. We have examined the effect of external electric field on preformed Amyloid beta peptides which are primarily responsible for several neurodegenerative diseases such as Alzheimer’s and Parkinson’s. Experiments are being carried out both invasively and non-invasively. For the non-invasive electric field exposure, a fabricated microfluidic platform is being used in which silver electrodes of 500 μ m thickness are patterned on glass slides using physical vapour deposition. Spectroscopic techniques such as Raman spectroscopy, Fluorescence spectroscopy, and Circular Dichroism are used to assay the protein samples.

Additionally, I was involved in simulations of particle tracing (using COMSOL) for inertial sorting of particles of micron sizes in a microchannel, fabricated using soft lithography. Therefore, I feel that I have a grasp over the fundamentals as well as the experimental exposure with a hands-on-training in some of the relevant fabrication methods and characterization techniques.

About Angstrofluidics and blue energy harvesting, I have gone through the review by Y You *et.al* (2022) and Lihan Xie *et.al* (2022). The research activities in this field are really intriguing, particularly the concept of ionic transport mediated by strong electric field inside nanochannels. I feel excited about this project and I feel motivated as the proposed research topic truly aligns

with my research interest. Additionally, I consider it a privilege to work with Prof. Radha Boya and Prof. Sunando DasGupta, in whose laboratory, I presently work for my Masters' thesis.

I have grown in an academic environment as my father is a lecturer and I have seen him teaching, explaining basic concepts and connecting with his students since I was a kid. This has inculcated a desire in me to be in academic research and I am truly interested to join the joint PhD program between the University of Manchester and IIT Kharagpur, both being cutting-edge institutions that prioritize fundamental concept-based research with application potential.

On a lighter note, unrelated to research, being a football fan, I always wanted to see two of the best club-teams in Manchester play in the English premier league.

I feel with my background and hard work I will be able to contribute to the scientific and technological issues relevant to this project and hope that my hard and perseverance can lead to new ideas and products related to energy harvesting.