Statement of Purpose – IITKGP and University of Manchester

-by Advait Gilankar

I first became interested in the field of science during my senior years in high school. I was fascinated with diverse physical and chemical applications of different materials. This interest led me to pursue a bachelor's in Metallurgical and Materials Engineering from one of the country's oldest and best technical institutes. Over the past four years, this program has taught and trained me in several aspects of design and engineering properties of various materials used in day to day lives. Apart from my Major, I also explored the field of Optoelectronics and Electroceramics through a micro specialization in 'Electronic Materials and Applications offered by the Materials Science Centre. My interest in learning more about energy materials and seriousness regarding solving the problems pertinent in this field led me to undertake research projects and enroll in various courses on materials for energy applications.

During my undergraduate studies, I worked on 'Energy Storage Materials' under the guidance of *Prof. S. B. Majumder and Prof. S. Das.* During these projects, I studied various electrodes and electrolytes used in different battery chemistries. I acquired a working knowledge of different instruments used in electrochemical and structural characterization of the electrode materials. The highlight of my research experience was developing a symmetrical Na-ion battery based on $Na_2VTi(PO_4)_3$ electrodes. This Na-ion battery can be used in future energy storage systems as it gives excellent rate-performance and cycling stability. *I published this work as a first author in the Journal of Alloys and Compounds.* Since July 2019 I have been working on a novel Kazakhstanite phase and its variants as electrodes for creating high-energy density batteries. This work is being considered for publication in the journal *ACS Applied Materials and Interfaces.*

My research projects gave me an opportunity to apply my theoretical knowledge from different courses on Materials Characterization. Apart from materials for energy storage applications, my elective & micro specialization courses made me aware of the on-going research in developing perovskite solar cells and hydrogen generation through water-splitting. Through my coursework on 'Atomistic Modelling' and 'td-DFT', I learned about various computational methods used in research. I also had a chance to use MedeA-VASP software during those courses. My undergraduate experience has helped me to grow in both the analytical and creative aspects. These projects helped me develop a practice of keeping a precise record of research experiments performed. I also learned that research takes patience and can lead to fruitful results through perseverance. I believe that these qualities will enable me to perform impactful research during in the future.

The dual-doctoral degree program offered by IIT Kharagpur and University of Manchester, offers me with a wonderful opportunity to apply my previously learned skills in materials characterization and learn new techniques. I would also get an opportunity to interact with new people and be introduced to research in new culture at Manchester. I believe that my knowledge, research skills and ability to adapt to newer settings would help me in exceling in this program and contribute more towards science.