

Statement of Purpose

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For: PhD Programme, IIT KGP & Univ. of Manchester

During my school days, my inclination towards science especially for physics motivated me to go for Mechanical Engineering as career option. During my under graduation, I gained basic knowledge about different subjects and developed interest in Thermal science. This interest in thermal science and being keen onto pursuing higher studies, I choose to go for M.Tech in Thermal Sciences.

I have joined Indian Institute of Technology, Bhubaneswar for my M.Tech in the department of Thermal science and engineering. During my Master's I've gained in depth knowledge of what thermal science is and got the complete essence of Thermal science. As a part of my course curriculum, I've taken Computational methods in thermals and fluid engineering course and this course with its vast applications in Thermal science made me take up this as my Master's thesis and have combined the CFD analysis with solidification modelling of Binary alloys.

Title: Modelling of Binary Alloy Solidification using OpenFOAM

Supervisor: Dr. Anirban Bhattacharya, IIT Bhubaneswar

Description: The primary aim of the present project is to develop and implement a model for solidification of binary alloys in the open-source software OpenFOAM with a focus on capturing the effects of solute concentration and cooling rate on the melt pattern and solute segregation. For this, an enthalpy porosity based model is used. The results are compared with the ones quoted in the literature and an excellent agreement with the results in the literature were found. The set of governing equations of mass conservation, momentum conservation, energy conservation and species conservation is solved based on a pressure-based Finite Volume Method according to the SIMPLE algorithm. The model thus developed is used for simulations of the solidification process of a binary alloy in a rectangular chamber with side cooling and the effect of solute concentration, the cooling rate on the melting

pattern and solute segregation is investigated. Using the same model developed, numerical simulations were carried out for the solidification of Pb-Sn alloys with different solute concentrations. Besides theoretical modelling, this project involves coding and simulation studies. Results successfully demonstrate the ability of the model in capturing solute segregation, thermo-solutal convection during the solidification process.

My objective is to enhance and strengthen my knowledge base in the field of Mechanical engineering. The ideal path towards this, I feel, would be by pursuing research. In the long run I seek to be the leader in my field, which requires fostering of team spirit and good will besides intellectual and creative enrichment. This dual PhD program by IIT KGP & Univ of Manchester with its team of highly motivated and industrious researcher scholars would hence be the ideal start to my research career. I can assure you that given a chance I shall strive to live up to the expectations.