SOP

Materials research in various frontier in the world of Science & Engineering, has taken a new jump in last few decades. The advent of Composite materials accelerated the scientific research in search for better combination of properties in service condition over the past few decades. Being a graduate student of Materials science of engineering, the versatility in the application of ceramics in different sector of materials application has excited me since my college days while pursuing my B.Tech.. The contribution of Ceramics towards the energy and environmental impact and healthcare, from energy conservation in furnaces (Refractories), in energy storage and generation (Battery, Supercapacitor), in energy conversion (Thermoelectric Devices, SOFC) and healthcare, to serve as a protective coating material, and in load bearing applications has been immense.

During my B.Tech. I have done my project on synthesis of "**Nanostructured Cordierite by using Sol-Gel technique"** before serving as a deputy manager in FCP (Flow Control Product) Technology division of TRL Krosaki Refractories limited, where I witnessed the practical aspect of ceramics as a heat conserving equipment in blast furnace and different flow control product (nozzle, slide gate, tundish etc.) used in steel industry. After brief Spell in the service, I have joined IIT Kanpur to pursue my Master's where I have done my thesis on **"Thermoelectric Performance of Nb doped $SrTiO_3$ Nanocomposite with Functionalized Graphene"** prepared by **Spark Plasma Sintering (SPS)** technique. Thermoelectricity is a unique concept for renewable energy generation by converting waste heat into electricity and become increasingly important concept in the midst of growing concern of global warming and in alleviating CO_2 emission with lesser use of conventional energy sources like fossil fuels and I have worked with our research team, to the best of my level in exploring thermoelectric potential of different Perovskite based oxides. **I have taken the course of Heat treatment and surface hardening and corrosion & Oxidation in metals and alloys to name a few,** during my M.Tech. at IIT Kanpur.

The utility of ceramics as the reinforcing second phase in metal matrix has been immense. Metal- matrix composite generally boasts superior properties than the monotonic matrix alloys and thus, they have become excellent candidate materials in various applications. Among the many manufacturing techniques for MMC's, laser assisted manufacturing techniques have emerged and drawn

increasing attention in the past decades. Laser assisted additive manufacturing have found its space in aerospace, automobile and other structural application with the advantage of cost effectiveness, enhanced mechanical and physical properties as compared to single or multiphase metal alloys. Aluminium based materials are the second most engineering material group after steels. The low melting temperature of aluminium and its good bonding between wide variety of reinforcements make Al-based alloys an ideal type of matrix material. Laser assisted AM involves ceramic particles to form Al-based MMCs, which are economically viable and which would generally bring certain strengthening effect but scarifying in material ductility, due to dispersion difficulty and reduced powder flowability. Laser assisted manufacturing of Al-SiC composite have recently gained popularity due to smooth bonding between SiC particulates and the matrix material. But the wear resistance of the composite drops when the size of the SiC particles increases, and crack density due to the thermal stress of contraction stress increases after the volume percent exceeds the mark of 15%. Here nano-$MgAl_2O_4$ reinforced Al matrix composite fabricated by laser assisted additive manufacturing can prove their potential if uniform distribution and residual porosity can carefully controlled - which I want to develop in my Ph.D., under the joint supervision of world-class faculty both at IIT KGP and University of Manchester and will try to become a researcher with a decent perception of the subject after completion of the programme.