STATEMENT OF PURPOSE

APPLICANT: BOLA PIUS ODUNARO
PhD. Materials Science and Engineering

I took a course titled "Materials Science during my undergraduate studies." This course exposed me to nanomaterials and their applications in broad fields, such as defence, aerospace, electronics, and biomedicine, and the importance of understanding their chemical properties, electrical properties, and mechanical properties to prevent materials failure. Through the class, I understand that to prevent materials failure in service and facilitate engineering implementation of materials, a comprehensive understanding of their properties and deformation mechanism is usually a prerequisite. As a result of this class, I developed an interest in further studying and understanding the mechanical properties, chemical properties, electrical properties of nanomaterials, the mechanics of the various materials' failure modes, and appropriate design principles employed to prevent in-service failures. Thus, I decided to pursue a PhD degree in Materials Science and Engineering, specifically in the areas of nanomechanics and plasticity and nanomaterials and nanotechnology. I would love to be a part of research that would be at the forefront of changing the world.

I obtained a diploma, higher degree (HND), and a B.Sc. in mechanical engineering, consistently placing in the top 1% of my class and graduating with distinctions. In particular, my bachelor's degree at the University of Ibadan exposed me to the intricacies of research. It gave me my first taste of the significance of practical engineering in modern society. Beyond my course work, which I aced with a final CGPA of 6.7/7.0, I also had opportunities to engage in relevant research. My final year thesis was on " Development and Performance Evaluation of a Mini-Potentiostat for Corrosion Experimentations." Performance evaluation of the potentiostat was implemented by performing corrosion experiments in 5 wt.% NaCl solution using mild steel as a working electrode (WE), Ag/AgCl as a reference electrode (RE), and Platinum wire as the counter electrode (CE). The analysis of the working electrode potential against the log of current-density plot at a scan rate of 10 mV/s of the fabricated potentiostat revealed a Tafel plot that conforms with results from commercially available potentiostat. Thus, the research project enabled real-time determination of the corrosion rate of the Mild steel and Al-Zn-Mg. I was fascinated by the research process and the necessary attention to detail more than the results. I also gleaned from the experience that it is possible to perform impactful science even with limited resources.

Due to my passion for research and my proficiency in engineering software which include; ANSYS, MATLAB, Autodesk Inventor, Comsol Multiphysics, PYTHON, etc., I worked as the team leader of a research group under the supervision of Dr O.O. Ajide. During my term as the team lead, we undertook four research projects: The Stress Analysis of a water tank stand at the department of Industrial Engineering, University of Ibadan, using Ansys. Other projects and research work include Case studies of failure analysis on failed engineering components, Finite Element Analysis of thick and thin plates using MATLAB software, and a Review on the Failure analysis of a failed spray dryer that has been in service for nearly 20 years at the Western Platinum Mine metallurgical plant. These allowed me to work in a team with a sense of focus and responsibility, always keeping in mind the eventual goal to be achieved. It was a rich experience as I learned the intricacies involved in research and the kinds of demands that it makes.

To expand my knowledge in mechanical behaviours of materials, I am currently a research assistant, researching "Modelling Fracture Characteristics, and Fatigue Cracks Propagation of Selected Structural Components" under Dr Olufemi Ajide at the University of Ibadan. Outside of school, I worked as an engineering intern at Flour Mills of Nigeria, I completed a compulsory one-year National Service as system reliability and asset assistant at the Jebba hydropower generation plant in Nigeria. In both positions, I was surprised by how greatly the choice of materials affected the efficiency of operations.

Outside of research, I was a member of the Beyond School Charity Club, where I mentored and provided academic assistance to less privileged children within the community. In addition, I coached many high school students on leadership and the importance of education. During my national youth service, I was also the adult and child education group president**.** My team and I promoted adult and child education in the local community, teaching uneducated adults how to read and write. As a team, we promoted child education by volunteering ourselves as tutors in high schools, teaching and preparing students for exams. These activities, in particular, helped me develop effective communication and the leadership skills necessary to manage a team successfully.

There are several faculties that I am keen to work with. Firstly Dr David Poerschke's supervision, whose research focuses on predicting the performance of materials and structures by using complementary experimental and computational tools to determine thermal, chemical, and mechanical stressors that contribute to the performance or failure of the system, completely resonates with my interest, and I will like to do more research in this area. Also, learning under Dr Nathan Mara's research focuses on using nanomechanical test procedures to characterize the differences in mechanical response between microstructures containing irradiation-induced defects. Finally, learning under Professor Andre Mkhoyan, whose research focuses on understating materials properties and behaviours at the atomic scale level to determine materials properties, ultimately resonates with my interest. Being open and interested in working with other faculty members with similar research interests.

I choose the University of Minnesota because of its excellent epicentre of ingenuity and knowledge creation., which will help me broaden my academic horizons and expand my bank of knowledge. Research in nanomechanics and plasticity and nanomaterials and nanotechnology in the department perfectly aligned with my career interests. I would be glad to benefit from the excellent opportunities for research in Materials Science and Engineering offered by the University of Minnesota. The excellent research facilities at the University of Minnesota and the able faculty guidance offer me an invaluable opportunity to complete my graduate studies. I am confident that I have the necessary drive, intellectual competence, and requisite skills to succeed in this program, to study PhD in Material Science and Engineering.

My long-term goal is to become a top-notch researcher by performing breakthrough research in nanomechanics and plasticity. Thus, after completing the PhD program will work as a postdoctoral in an institution and continue further research on nanomechanics and plasticity by developing a system for simulations and measurements of nanomaterials' mechanical behaviours at nanoscale levels developing better methods to protect materials from failure.