UNNC – SDU (SEPE) Doctoral Training Partnership

It's essential that you have contacted the UNNC and/or SDU supervisors before applying.

Formal applications should follow the instructions in 'How to apply' section.

Research areas

1. Green energy and low/zero carbon engineering & science
2. Recycling of solid wastes as green materials and value-added products

Available PhD topics

PhD topic	**Development of opto-microfluidic technology and apparatus for in-line detection and distinction of common radionuclides in nuclear power plants**
SDUGER Supervisor	Prof. Ning Qin
UNNC Supervisor(s)	Prof. Yong Ren
Short introduction & description of the PhD project	Nuclear energy receives enormous attention worldwide recently due to urgent demands of carbon-free energy and the rapid progress of artificial intelligence technology. Nuclear fuel reprocessing and radioactive waste management both involve regular sampling and analysis of the materials and environment, which may cause potential exposure of the workers to the radioactivity. In this sense, the drastic reduction of sample volumes (from a few milliliters to a few microliters or nanoliters) and miniaturization of analytical devices, if possible, become essential needs and preferred merits for proper monitoring and assessment. This PhD project aims to explore the feasibility of and develop lab-on-a-chip technology by combining microfluidics and photonic methods, e.g., UV-Vis or Raman spectroscopy, for detection and quantification of common radionuclides found in nuclear power plants. It is anticipated that a prototype of the detection apparatus based on the explored technology be developed when the project is completed.
Contact points	Informal inquiries may be addressed to Dr. Ning Qin (n4qin@sdu.edu.cn) and Dr. Yong Ren (yong.ren@nottingham.edu.cn).
PhD topic	**Kinetic roles of plasma assisted ammonia-hydrogen combustion**
SDUGER Supervisor	Prof. Wenbin Yu

UNNC Supervisor(s)	Prof. Jun He
Short introduction & description of the PhD project	The ever-increasing demand for decarbonization of combustion technologies in order to reduce or eliminate undesirable emissions has created a major challenge. Ammonia has recently been explored as a promising carbon-free fuel and a great alternative to hydrocarbon fuels to achieve zero-carbon emissions. However, despite its advantages over hydrogen, ammonia combustion has some drawbacks including low burning velocity, flame stability, and high NOx emissions. This project focuses on the principles of chemical kinetics of ammonia-hydrogen fusion combustion and NOx reduction coupled with the chemistry, kinetic mechanisms and impact of low-temperature plasma on ammonia combustion (i) construction of multidimensional numerical models; (ii) setup of optical diagnostic test system; (iii) plasma NOx reduction technology.
Contact points	Informal inquiries may be addressed to Prof Jun He (Jun.He@nottingham.edu.cn) and Prof Wenbin Yu (wbyu@sdu.edu.cn).
PhD topic	**Biomass/Methane catalytic Thermochemical Conversion for hydrogen and carbon material co-generation via advanced fluidisation technology**
SDUGER Supervisor	Prof. Ziliang Wang
UNNC Supervisor(s)	Prof. Nicholas Musyoka
Short introduction & description of the PhD project	Green hydrogen and carbon materials have broad applications in different industrial sectors. They can be obtained from sustainable hydrocarbons, namely biomass or green methane. However, it is challenging to efficiently convert those hydrocarbons into them. On the other hand, Artificial intelligence (AI) is a powerful tool that is changing the research paradigm. Integrating AI tools into biomass valorisation will undoubtedly accelerate the scientific research process and may yield unexpected insights and results. So, it will be a very interesting and exciting research area that combines the use of AI, hydrocarbon conversion, hydrogen and carbon materials co-generation. Specifically, this PhD project will focus on applying AI tools (1) to design high-performance catalysts for biomass or methane conversion to produce hydrogen and carbon materials, (2) to understand the key elements such as hydrogen and carbon mitigation during the thermoconversion process in a fluidized bed, (3) to develop an approach of producing high-valued carbon materials.
Contact points	Informal inquiries may be addressed to Prof. Nicholas Musyoka (Nicholas.Musyoka@nottingham.edu.cn) and Prof. Ziliang Wang (zwang2022@sdu.edu.cn).
PhD topic	**Numerical and Experimental Studies on the Flow and Heat Transfer Characteristics of Manifold Microchannel Heat Sinks**
SDUGER Supervisor	Prof.Dr. Jingzhi Zhang
UNNC Supervisor(s)	Prof.Dr. Yong Ren
Short introduction & description of the PhD project	With the swift advancements in modern science, technology, and industry, electronic equipment and devices are gradually becoming more compact, miniaturized and high-powered. Consequently, the heat flow from electronic components continues to rise, leading to the accumulation of heat in localized

	regions, which results in excessive local temperature elevation and non-uniform distribution of temperatures. The failure of electronic components can be attributed to various factors, including temperature, humidity, vibration, and other conditions. Notably, excessive temperature alone accounts for more than half of all failures. To address the thermal management problem, MMC heat sinks have emerged as an effective solution for dissipating heat from electronic components.
Contact points	Informal inquiries may be addressed to Prof.Dr. Yong Ren (Yong.ren@nottingham.edu.cn) and Prof.Dr. Jingzhi Zhang (zhangjz@sdu.edu.cn).
PhD topic	**Experimental Proof-of-Concept of HiL Based Virtual Calibration for a Hybrid Vehicles with Advanced Energy Management Strategy**
SDUGER Supervisor	Prof. Feiyang Zhao
UNNC Supervisor(s)	Assistant Professor Jing Bie
Short introduction & description of the PhD project	The increasing complexity of modern combustion engines together with the substantial variability of hybrid electric powertrains, lead to new challenges in function development, system integration and vehicle calibration processes. The hardware-in-the-loop (HIL)-based virtual calibration technology for power machinery significantly enhances the efficiency and flexibility of electronic controller calibration, reducing dependency on physical experiments and lowering development costs. In fact, the energy management concepts are holistically addressing multi-factors of solving efficiency of Hybrid Vehicles (e.g. pollutant emissions, fuel consumption, etc.) and other relevant environmental issues. This project will focus on two major dimensions on (i) reinforcement learning algorithms of energy management in a transient switching state and (ii) Multi-system integration with HIL to investigate various real driving scenarios for calibration purposes.
Contact points	Informal inquiries may be addressed to Dr Jing Bie (Jing.Bie@nottingham.edu.cn) and Prof Feiyang Zhao(fyzhao@sdu.edu.cn).
PhD topic	**Biochar Adsorption Modification and Its Coupling with Cementitious Materials for Enhanced CO_2 Mineralization**
SDUGER Supervisor	Dr. Xujiang Wang
UNNC Supervisor(s)	Dr. Mengxia Xu Prof. Bo Li
Short introduction & description of the PhD project	Achieving global net-zero emissions requires innovative technologies to reduce atmospheric CO_2 concentrations while supporting sustainable development. Carbon capture and utilization (CCU) technologies, which integrate CO_2 sequestration with material production, offers a promising solution. Among these, biochar-based materials have gained attention for their dual role in capturing CO_2 and enhancing the performance of cementitious composites, addressing both environmental and engineering challenges. This PhD project focuses on developing biochar materials from widely available biomass and enhancing their CO_2 adsorption capacity through advanced modification techniques. The modified biochar will be integrated with

	cementitious materials to enable dual internal and external CO_2 curing in a CO_2-rich environment, improving both carbon sequestration and material performance. The research will optimize the biochar's CO_2 adsorption and controlled release properties within the cementitious matrix to enhance carbon fixation, while refining its porous structure to facilitate efficient CO_2 transport and maximize mineralization, contributing to the advancement of sustainable construction materials.
Contact points	Informal inquiries may be addressed to Dr. Xujiang Wang (x.wang@sdu.edu.cn), Dr. Mengxia Xu (mengxia.xu@nottingham.edu.cn) and Prof. Bo Li (Bo.li@nottingham.edu.cn).
PhD topic	**Decoupling and High-Value Utilization of Organic and Inorganic Materials in Waste Fiberglass**
SDUGER Supervisor	Prof. Yanpeng Mao
UNNC Supervisor(s)	Dr. Mengxia Xu
Short introduction & description of the PhD project	Waste fiberglass products are generated in large quantities and are widely distributed, posing significant challenges to sustainable waste management. To advance the development of zero-waste cities and foster green, circular growth for industries, innovative and reliable technologies are urgently needed to decouple and maximize the value of organic and inorganic materials in waste fiberglass. This PhD project aims to develop advanced recycling solutions for waste fiberglass using fiberglass furnace-based technologies. By employing offline pyrolysis and gasification techniques, the organic components of waste fiberglass will be thermally decomposed to produce high-calorific-value gas, which can serve as a partial fuel substitute. Meanwhile, the remaining inorganic components will be safely processed and reused as a partial raw material substitute in the furnace. This integrated approach not only enables energy recovery from organic solid waste but also facilitates material recovery from inorganic solid waste, offering a sustainable and strategically significant solution to waste fiberglass management.
Contact points	Informal inquiries may be addressed to Dr. Mengxia Xu (mengxia.xu@nottingham.edu.cn) and Prof. Yanpeng Mao (maoyanpeng@sdu.edu.cn)
PhD topic	**Numerical and Experimental Studies on the Flow and Heat Transfer Characteristics of Manifold Microchannel Heat Sinks**
SDUGER Supervisor	Prof.Dr. Jingzhi Zhang
UNNC Supervisor(s)	Prof.Dr. Yong Ren

Short introduction & description of the PhD project	With the swift advancements in modern science, technology, and industry, electronic equipment and devices are gradually becoming more compact, miniaturized and high-powered. Consequently, the heat flow from electronic components continues to rise, leading to the accumulation of heat in localized regions, which results in excessive local temperature elevation and non-uniform distribution of temperatures. The failure of electronic components can be attributed to various factors, including temperature, humidity, vibration, and other conditions. Notably, excessive temperature alone accounts for more than half of all failures. To address the thermal management problem, MMC heat sinks have emerged as an effective solution for dissipating heat from electronic components.
Contact points	Informal inquiries may be addressed to Prof.Dr. Yong Ren (Yong.ren@nottingham.edu.cn) and Prof.Dr. Jingzhi Zhang (zhangjz@sdu.edu.cn).

Other potential supervisors

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