EPSRC & SFI Centre for Doctoral Training in Advanced Metallic Systems

EngD in Environmental Impact of Alternative Blast Furnace Ironmaking Materials.

Supervisors: Dr Richard Thackray & Dr Rachael Rothman
Based at: The University of Sheffield
Collaborator: Tata Steel & British Steel
Stipend: UKRI stipend (£15,609 in 2021-22) plus £4,000 per year
Open to: Candidates with a strong degree in a STEM discipline

The Centre for Doctoral Training in Advanced Metallic Systems is a partnership between industry partners and the Universities of Sheffield and Manchester and the I-Form Advanced Manufacturing Centre, Dublin. CDT students undertake a doctorate with an in-depth technical and professional skills training across a structured 4-year programme. For more information on our cohort training programme and our impact from our doctoral research projects with industry please visit www.metallicscdt.co.uk.

SUSTAIN (www.sustainsteel.ac.uk) is an exciting £35M collaborative project between the Universities of Swansea, Warwick and Sheffield working in partnership with the UK steel industry. This EngD project will link to the first grand challenge in the SUSTAIN Hub of 'Zero Waste, Carbon Neutral Iron and Steelmaking' with the aim of decarbonizing iron and steel manufacturing, and so aligns closely to the Advanced Metallics DTC.

Ironmaking uses large amounts of coal & natural gas fossil fuel to sinter iron oxides along with coke and injected coal in the blast furnace. Whilst there are significant commercial & environmental drivers to reduce fossil fuel use, there are also technical challenges related to the use of replacing fossil fuels with alternative materials. Possible alternative materials include biomass, plastics, by-products from other parts of the steel production process, and waste material from other industries.

A key part of assessing the suitability of replacement raw materials in the ironmaking process is an assessment of the environmental impact of the substitute material. The most widely used and accepted technique to assess this type of impact is Life Cycle Assessment (LCA). An LCA is a systematic technique used to analyse the environmental aspects and potential impacts associated with a product at all stages across the life cycle chain.

LCA techniques will be employed to compare environmental assessments of current versus proposed blast furnace ironmaking processes with substituted materials in a series of different scenarios. In this way, the impact of replacement materials will be calculated, and so the most promising replacement materials can be identified. Process models will be included to provide information of the environmental impact and Life Cycle Costing (LCC) will be used to test the technical data to provide an analysis of the potential cost benefits of replacing current raw materials. The new work proposed here will focus on the environmental assessment related to changing carbon usage within ironmaking along with the potential impacts on the changing by-products and their fate.

The successful applicant for this EngD will work closely with the research team at Swansea, who are conducting a programme of experimental studies on raw material processing and behaviour under simulated blast furnace conditions, and as such the LCA work in this project will link strongly with the experimental studies. The successful applicant for this post will also have the opportunity to work closely with the wider UK steel industry, in particular the environmental research group at Tata Steel UK, as well as the ironmaking groups at Tata and British Steel.

For more information on the project, please contact Richard Thackray (r.thackray@sheffield.ac.uk).