



2024 AIST John F. Elliott Lecture

The Green Steel Revolution

The steel industry is under pressure for contributing 7% to 9% of worldwide carbon dioxide equivalent emissions (CO_2e) and, as steel will always be a part of our infrastructure, ways to mitigate these emissions must be found.

In 2015, the International Energy Authority (IEA) postulated the ultimate solution to net zero by 2070 was conversion of the heavy-emissions steelmaking route (blast furnace/basic oxygen furnace (BF/BOF)) to electric arc furnace (EAF) melting of hydrogen direct reduced iron (H_2 DRI). Why? Globally, 72% of steel is produced via the BF/BOF route, which, due to its dependence upon coke, produces 90% of steel's CO_2e emissions. The EAF route, on the other hand, produces only 10% of the current emissions and, by charging H_2 DRI, will produce almost zero emissions, generating an incredibly significant impact.

Whilst the BF/BOF to H_2 DRI EAF conversion is technically feasible, the H_2 DRI EAF route is fraught with challenges. These challenges will be enumerated along with possible intermediate solutions and an overview of the new technologies being developed which have a technology readiness level (TRL) of 3 to 7 (laboratory to demonstration stage), with some new innovative processes achieving TRL 7 in less than 3 years.

There is still room in this green steel revolution to capitalize on “out of the box thinking” to develop even more techno-economic solutions for the steelmaking option pool. Discover options available for a career in the new and exciting steel industry as part of the green steel revolution.



Contact

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Biography

Sara Hornby, variously described as a trailblazer and an inspiration for ambitious women, has

continually proven nothing is out of reach for women in engineering. The first woman to graduate from Sheffield Hallam University with a B.Sc. Hons. in metallurgy and a Ph.D. in industrial metallurgy, she spent her early career in the U.K. working for Firth Brown Tools Engineering and British Steel Corp. Her initial Canadian and U.S. Air Liquide roles, developing new technologies and bringing best available technologies to the metals industry (whilst managing multi-disciplinary, multi-location team members), coupled with other electric arc furnace steelmaking optimization positions (Tenova Goodfellow, Midrex, Linde, Intertech, TMS International), put her in good stead to set up her own company, Global Strategic Solutions Inc., which supplies expert consultancy and expert witness to the metals and related industries.

Hornby holds five patents and has authored over 136 International papers, seminars and courses. She is a Fellow of the Institute of Materials, Minerals and Mining (IoM3) and was their 2022 Hadfield Medal and Prize winner. In 2020, she was the recipient of the Benjamin Fairless Award and the John Bell Award. In November 2023, was awarded an Honorary Doctorate in Engineering by Sheffield Hallam University in recognition of her outstanding contribution to the international steel industry.

The AIST John F. Elliott Lectureship was established in 1990. This honorary lectureship is designed to acquaint students and engineers with exciting opportunities in chemical process metallurgy; inspire them to pursue careers in this field; inform the public of the contributions of chemical process metallurgy and materials chemistry to the association; and honor the late Prof. John Elliott of the Massachusetts Institute of Technology for his many accomplishments and the leadership that he provided during his career.