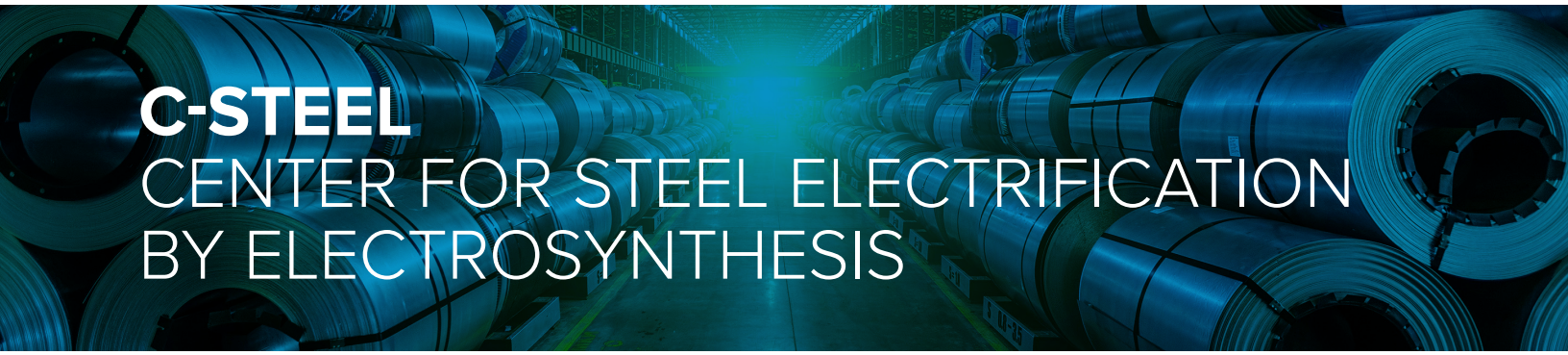
C-STEEL
Center for Steel Electrification by Electrosynthesis



C-STEEL
CENTER FOR STEEL ELECTRIFICATION BY ELECTROSYNTHESIS

The Center for Steel Electrification by Electrosynthesis (C-STEEL) aims to develop a cost-effective process that will replace blast furnaces in steelmaking, significantly reducing greenhouse gas emissions.

THE CHALLENGE

Steel is a vital material with widespread applications in transportation, construction, and various other industrial sectors. However, steel production contributes significantly to global greenhouse gas emissions, in large part because of the high temperatures required. The steel industry thus faces challenges in decarbonizing due to these substantial heat requirements and other direct carbon emissions, particularly in the production methods involving blast furnaces.

THE CENTER

Argonne National Laboratory spearheads C-STEEL, one of 11 new Energy Earthshot Research Centers funded by the U.S. Department of Energy (DOE). Collaborating with Oak Ridge National Laboratory, Case Western Reserve University, Northern Illinois University, Purdue University Northwest, and the University of Illinois Chicago, C-STEEL is a multi-institutional effort. The research receives funding from the DOE Office of Basic Energy Sciences and Advanced Scientific Computing Research programs.

C-STEEL's groundbreaking research focuses on an electrodeposition process that uses electricity to produce useable iron metal from solutions that contain dissolved iron ores. The liquid acts as an electrolyte similar to that found in batteries, where electricity also drives the movement of the more familiar lithium ions.

C-STEEL will investigate two different liquid mediums that have unique effects on deposition reactions: water-based solutions at room temperature and molten salt solutions at slightly higher temperatures. As part of the process design effort, C-STEEL will develop a specially designed artificial intelligence platform to predict the most efficient assembly of iron in the liquid. It will draw upon the computational resources of the Argonne Leadership Computing Facility as well as the Oak Ridge Leadership Computing Facility, both of which are DOE Office of Science user facilities.

The combined efforts in C-STEEL aim to understand the fundamental mechanisms of iron metal electrodeposition to ensure that useable steel can be produced.

In line with fostering diversity in research, C-STEEL collaborates with a minority-serving institution. The center also actively engages in outreach initiatives, mentorship programs, and career development opportunities for students and postdocs.

THE IMPACT

C-STEEL aims to address the environmental impact of steel production by targeting the extreme heat requirements of blast furnaces, which operate at over 1,600 degrees Fahrenheit. The goal is an ambitious 85% reduction in greenhouse gas emissions by 2035. The center's research endeavors to develop an innovative and cost-effective process to replace traditional blast furnaces in steelmaking. Success in C-STEEL's mission promises significant benefits for both the environment and the economy, providing a sustainable and economically viable alternative to conventional steelmaking processes.

CONTACT

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