

2021-2022 GRANT RECIPIENT REPORT

Tim Eisele

MICHIGAN TECHNOLOGICAL UNIVERSITY STEEL CURRICULUM DEVELOPMENT GRANT

This project at Michigan Technological University is intended to update the ironmaking curriculum included in the Hydrometallurgy/Pyrometallurgy course. The goals of the project are as follows: Review literature for new technological developments in improving the sustainability of ironmaking processes; visit ironmaking facilities and industry laboratories to discuss current and future developments for incorporation into the course; build a small demonstration-scale electric arc furnace for use in course demonstrations; solicit external speakers; and establish a process for continuously updating the course materials going into the future.

The literature review proceeded as planned, and considerable effort has gone into adapting the course so that it can be taught remotely as well as in person.

Contacts with industry and external speakers have primarily been carried out via web conferencing. In the face of the pandemic travel restrictions, it was not possible to bring speakers physically to Michigan Tech or to travel to industrial facilities to the extent originally planned. Now that travel restrictions have largely been lifted, the intent is to use the remaining funds to carry out the travel-related portions of the project. This will provide access to information about actual industrial practice and recent innovations that will continuously be integrated with the course materials.

A small (220-amp) electric arc demonstration furnace has been constructed, capable of melting approximately 100 g of metal. This is small enough to fit inside of an exhaust hood for fume handling. Appropriate protective gear was provided for students operating the furnace. It has been used by students to illustrate the melting of metals by an electric arc. The power supply is capable of providing both AC and DC current, with graphite electrodes and suitable crucibles used to replicate the processes used in full-scale electric arc furnaces. The ability to use both AC and DC makes it possible to carry out pure melting in AC mode, or to combine melting with oxide electrowinning in DC mode. The plan going forward is for this furnace to provide a small, fairly safe, comprehensive unit for students to experiment with variations on electric furnace steelmaking technology.



Team members from Michigan Technological University included (left to right): Zachary Geiger, Pablo Lozano, Ryan Turner and Noah Hodsdon.

Seven students have been involved in the project to date; six undergraduates and one graduate student. Two of the undergraduates received their degrees in 2020 and are currently employed by companies that provide raw materials and services to customers that include the iron and steel industries. An additional four undergraduates participated in testing of the small demonstration arc furnace in 2022.

The team leader has been in contact with personnel from Cleveland-Cliffs Inc. and Nucor Corp. to obtain information to be used in the course, as well as to provide samples of material for use in class demonstrations and projects. ♦