

2021-2022 GRANT RECIPIENT REPORT

Nilesh Kumar THE UNIVERSITY OF ALABAMA KENT D. PEASLEE JUNIOR FACULTY AWARD

This project involves a strategy to forge a relationship with Nucor Corp., steps to be undertaken to create interest among students in the steel industry, and an approach to organize a steel-related event at The University of Alabama.

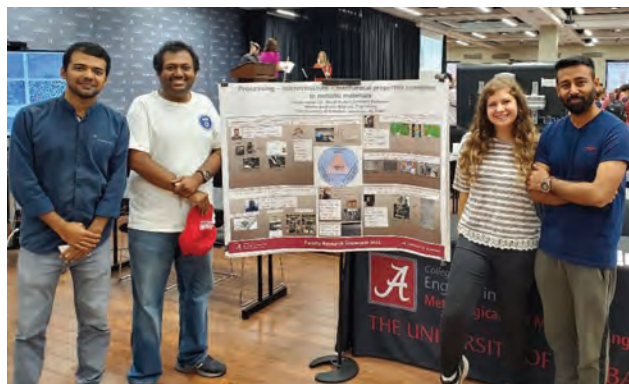
The research work proposed involved establishing processing – microstructure – mechanical properties correlation in a new grade of dual-phase steel developed by Nucor Corp. for automotive lightweighting. It was proposed that, by controlling intercritical annealing temperature and cooling rates, the phase types and their relative volume fractions would be changed that might have a bearing on mechanical properties such as strength, ductility, work hardening rate and formability parameters.

A suite of advanced microstructural tools such as scanning electron microscope and transmission electron microscope and mechanical properties characterization tools including digital image correlation was proposed to be employed in this study. It is hoped that, ultimately, in combination with other activities planned, the project would aid in the development of a skilled workforce for the steel industry.

During the 2021–2022 academic year, a number of activities were pursued to expose students to steel and create interest in the steel industry. The accomplishments for the academic year 2021–2022 are as follows:

1. Continued funded research collaboration with ArcelorMittal to work on line pipe steel.
2. Collaboration with SSAB for microstructural characterization of nano-sized precipitates using transmission electron microscopy.
3. Received a U.S. Department of Energy/Small Business Innovation Research award to work on oxide dispersion strengthened ferritic steel 14YWT (a potential candidate material for advanced fission and fusion reactors) in collaboration with enabled engineering.
4. Research on a new grade of multi-phase steel in collaboration with Nucor Steel-Decatur LLC.
5. Five oral presentations, three poster presentations, four conference papers and two journal papers published.

6. Organization of Steel Day 2022 where nine steel/ steel-related companies participated.
7. Participation in AISTech 2022 by three students where one student won third prize in the poster presentation competition.
8. Recruitment of a new graduate student for steel-related research.
9. Development of a new course on ferrous metallurgy.



Graduate students participated in the Facility Research Showcase in November 2021 at The University of Alabama.

The initial proposal highlighted that the main reason behind the steel industry's declining skilled workforce was a lack of interest among youths to pursue a career in steel-related industry. A deteriorating infrastructure in the U.S. for steel-related education at higher-education institutions and society's negative stereotype of the manufacturing industry were noted as factors responsible for today's skilled workforce situation.

In that regard, several strategies were proposed under three broad categories highlighted by the AIST Foundation for the Kent D. Peaslee Junior Faculty Award application to increase awareness among youth about the steel industry so that their engagement with steel industries can be enhanced.

- Strategies to establish connection with a steel industry. The proposed activities were as follows:
 - Special lectures during steel-related course at The University of Alabama by metallurgists working in the steel industry.
 - Plant tours.
 - Steel-related research with a steel company to provide students opportunity to work on industrially relevant problems.
- Activities toward building students' interest in the steel industry. It included several strategies to accomplish this goal. Those strategies are:
 - Steel-related course development at the undergraduate level.
 - Middle and high school teachers' engagement in steel-related activities.
 - Engaging rising high school juniors and seniors interested in science, technology, engineering and mathematics.
 - Supporting steel-related activities in Material Advantage chapter at The University of Alabama.
 - Recruiting graduate and undergraduate students to work on steel-related research.
- Steel-related student campus event and other programs to obtain direct student contact with the steel industry (Steel Day).

The idea behind selecting each activity under each topic was to leverage existing resources on the campus of The University of Alabama, in the city of Tuscaloosa,

and in the state of Alabama before expanding further. It was done very strategically for maximizing resource utilization and broadening the impact of each activity. For example, to build students' interest in the steel industry, two activities proposed were (i) middle and high school teachers' engagement in steel related activities and (ii) engaging rising high school juniors and seniors interested in science, technology, engineering and mathematics. The University of Alabama hosts ASM Teachers Materials Camp in June every year geared toward middle and high school teachers to introduce them to materials science and engineering. It involves lectures, live demonstration and hands-on activities.

To address activity (ii), the target audience was high school juniors and seniors participating in Student Introduction to Engineering (SITE) program organized by the College of Engineering at The University of Alabama. These students are interested in science, technology, engineering, and mathematics and come to The University of Alabama campus for five nights every summer to participate in the SITE program. Some of the planned activity under this were: (I) delivering a lecture on materials science and engineering discipline and incorporating many examples taken from steel metallurgy in the lecture, (II) providing a lab tour and hands-on demonstration on research related to mechanical behavior of metallic materials including steels to all students participating in SITE program, and (III) a trip to a Nucor steel plant to expose them to steel manufacturing. ◆

Did You Know?

In fulfillment of its mission to ensure the iron and steel industry of tomorrow will have a sufficient number of qualified professionals, the AIST Foundation Board of Trustees has a stretch goal to increase grants and awards from the current annual level of US\$900,000+ to more than US\$1,000,000 by December 2024.

To reach this level of annual giving, the Trustees need to raise a total of US\$2,000,000 over the next two years. Please consider a philanthropic gift to the AIST Foundation, a 501(c)(3) public charity.