

Grant Recipient Report

Kent D. Peaslee Junior Faculty Award

Mario Buchely, Missouri University of Science and Technology

This report outlines the first year of Mario Buchely's contributions as a 2023–2024 Kent D. Peaslee Junior Faculty recipient. His achievements in advancing the understanding and application of steel-related processes, along with his commitment to fostering collaboration between academia and industry, are undeniable. The report focuses on his initiatives to spark student enthusiasm and interest in the steel industry, including the development of a “forging-in-the-box” educational tool and expanding his digital outreach beyond YouTube. With the support of mentors from academia and industry, Buchely aims to further his research, mentorship and outreach activities, contributing to the growth and innovation of the steel industry.

Buchely's “Forging-in-the-Box” concept — designed to attract a new generation of students to the field of metallurgy and steelmaking — utilizes an induction heating element to rapidly heat a small metal blank, which is then forged within a closed die to achieve the desired final shape. He recently utilized this equipment in various demonstrations and volunteer events, successfully showcasing the core concept of Forging-in-the-Box. However, further development is underway to refine the system into a fully functional tool. To achieve this, he plans to incorporate a mold design that will enable the creation of final forged pieces with specific shapes. Additionally, the design of the induction coil will be revisited to facilitate the attainment of higher temperatures, crucial for forging a wider range of metals.

In addition to these efforts, a more dedicated social media presence on YouTube, Instagram and Facebook, has been established to engage people in learning about the field of materials science and engineering. Buchely is committed to creating high-quality content that is tailored to resonate with a diverse audience, from students and professionals to anyone with a curiosity. To further amplify his reach, Buchely plans to strategically expand his social media presence across a wider range of platforms, i.e., X, Snapchat, TikTok and Pinterest.

Buchely's proactive outreach efforts have yielded significant results over the past year. By fostering connections with various steel-related companies, he has successfully secured participation in new research projects. To bridge the gap between academia and industry, Buchely has actively engaged students by inviting guest speakers to the Missouri University of Science and Technology (Missouri S&T) Materials Science and Engineering (MSE) seminars during the fall 2023 and spring 2024 semesters. These seminars featured industry professionals who shared their expertise with both undergraduate and graduate students, fostering valuable interaction and participation. He actively works on bridging the gap between classroom learning and real-world applications by supporting senior design projects. Last year, he mentored a team of four undergraduate students in the Missouri S&T MSE program. Their project, titled “Morphology and Kinetics of Ferrite Formation in Steels at Intercritical Temperatures,” was sponsored by Caterpillar Inc.

Buchely actively expands his professional network and stays abreast of the latest advancements in steel processing by attending key industry conferences. Over the past year, his participation included the MS&T 2023, DoD Summit 2023, AISTech 2024, and the 3rd International Symposium on Recent Developments in Plate Steels. During the last year, different plant tours were sponsored including Nucor Steel Memphis Inc., Nucor Steel Sedalia LLC and the Caterpillar Tech Center. During the last year, two undergraduate students were fully supported, and four students were partially supported by this grant.

During the last year, different student activities were fully or partially supported by this AIST grant. Buchely will continue to guide and lead groups of students in various competitions and presentations at esteemed conferences such as AISTech, IMAT, TMS, and MS&T. Through these opportunities, students have the chance to showcase their research findings, develop their presentation and communication skills, and further establish themselves in the steel industry.

During summer 2023, he served as a tutor for the ASM camp geared towards prospective metallurgy students. This valuable experience allowed him to share his knowledge and passion with aspiring professionals in the field. Buchely's commitment continues, and he was slated to participate in the ASM camps in 2024. These events provided valuable opportunities to showcase the exciting world of materials science and engineering, particularly within the realm of steel, to K–12 students. Buchely remains dedicated to such outreach activities, aiming to further increase the visibility of the Missouri S&T and MSE department, and spark a passion for science and steel in younger generations. Buchely's commitment to inspiring future generations extends to a series of webinars he hosted throughout the past year. His dedication to student engagement further extends beyond his own webinars. Buchely was also invited to be a guest lecturer on steel metallurgy in the fall 2023 MET ENG 2410: Applied Metal Forging course, providing valuable insights to students directly enrolled in the program. ♦