



Michigan Technological University
**Materials Science
and Engineering**



Richard Witte Endowed Professorship

2024 Annual Report

Jaroslav Drelich

The initial intention for the first-year funds of the Richard Witte Endowed Professorship was to support Prof. Drelich's research program focused on the design, development, characterization, and testing of medical implants. The plan was to use the funds to partially support a visiting professor and a PhD student from Iran who were set to join Michigan Tech in July/August 2023. However, due to delays in obtaining US visas for both individuals, the support focus shifted. A portion of the funds were used as cost share for purchasing a new Arcast Arc 200 arc melting furnace, which will allow the research teams at Michigan Tech to cast novel metal alloys in small volumes.

In recent months, my research at Michigan Tech has been heavily focused on developing temporary biodegradable orthopedic implants made of magnesium alloys that can provide crucial biomechanical support during bone repair and healing processes, while gradually being replaced by host tissue. However, creating magnesium alloys with the necessary mechanical and corrosion properties has proven to be a significant challenge. The research program under this professorship is addressing this challenge by eliminating the coarse secondary phases through trapping a large number of solute atoms in the magnesium matrix using rapid solidification techniques. Leveraging the Arcast Arc 200 will facilitate the exploration of non-equilibrium processing methods of rapid solidification, potentially leading to the production of nanogained structured alloys with reduced degradation rates and improved mechanical and corrosion properties. This innovative technology could open up additional opportunities for funding from the US National Institutes of Health.

The nearest-future plans include funding:

- the materials characterization instrument use fees for a PhD student researching inert polymeric coating of metallic orthopedic implants; and
- prototyping braided vascular stents made of biodegradable metal alloys.

As sponsor funding ebbs and flows, this Endowed Professorship will be a valuable resource to enable my research program to continue by funding personnel and services as needed.