



STEEL CURRICULUM DEVELOPMENT GRANT

Year-End Report

2025-2026

Project Title: **Academia–Industry Collaboration for Applied Research and Student Development**

Team Leader. **Montserrat Sofía López Cornejo**

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Team Members (include name, class, and major)

1. Diego Viveros Zavala, Senior Year, Materials Engineering.
2. Manuel Alejandro Bucio Sevilla. Junior Year, Materials Engineering.
3. Juan Carlos Vilchez Pedraza. Sophomore year, Materials Engineering.
4. Sofía González Espinosa. Sophomore Year, Materials Engineering.
5. Emmanuel Lozano Maldonado. Senior Year, Materials Engineering.
6. Jorge Antonio Reyes Morales, Senior Year, Materials Engineering
7. Isabel Bucio Herrejón, Graduate Student, Master's in Metallurgy
8. Janeth-Guadalupe Anguiano-Garcia, Senior Year, Materials Engineering

Project Summary:

The project regarding the Steel Curriculum Development Grant has the main goal of introducing the students to solving real-life problems within steel-related processes, which helps them understand the many variables influencing steel quality and production efficiency. This experience deepens their technical understanding and transforms the perception of the steel industry, offering a practical perspective on how metallurgy works beyond textbooks.

During the first year, 5 undergraduate students from the Materials Engineering department participated in technical training in heat treatments by the company EQUIMSA Especialidades Químicas Monterrey. The training led 2 students to participate in the HTS Strongbar competition in Detroit, Michigan, and the Emerging Professionals contest in Monterrey, Nuevo León, organized by ASM International.

54 students attended 3 plant tours to TREMEC and Safran Landing Systems at Querétaro, México, and Metalinspec Laboratories in Monterrey, Nuevo León.

From February 2026 to date, 7 undergraduate students have been involved in performing heat treatments on SAE 9254 and SAE 8620 steels subjected to quenching in a 10% and 20% alkylene glycol (PAG) solution under different stirring conditions. By now, 4 abstracts have been accepted in the MS&T 2026 Technical Meeting under the Advances in Ferrous Metallurgy Symposium, organized by AIST.

Project Goals:

1. Student training in Heat Treatment
2. Build academic-industry working teams.
3. Establish research goals aligned with industry needs and identify operational challenges.

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Project Details:

1.- EQUIMSA - Especialidades Químicas Training Session (July 2025)

Material Advantage Students at Instituto Tecnológico de Morelia have participated in the HTS Strongbar competition, organized by ASM International since 2021. In this contest, student teams perform heat treatments on a defined steel specimen to optimize its mechanical properties.

To carry out heat treatment processes applied in industry, Eng. Israel Bernal Melo, a specialist in industrial quenchants from EQUIMSA – Especialidades Químicas Monterrey, offered a 2-day seminar on the correct use of quenching media and accompanied the students in three different demonstrations using quenching oil.

Manuel Alejandro Bucio and Isabel Bucio participated in the HTS Strongbar competition at Detroit, Michigan, from October 21-23, 2025, presenting a 9254 steel bar that was quenched with oil and then tempered, in order to improve its toughness. The team represented Instituto Tecnológico de Morelia, obtaining a third place in the competition.

2.- Plant tours to connect knowledge with the industry processes (September and December 2025)

25 students from the Materials Engineering program, including part of the team that is considered in this project, visited the facilities of Safran Landing Systems and TREMEC in the city of Querétaro.

TREMEC is a leading global designer and manufacturer of high-performance, technologically advanced drivetrains and subsystems for conventional and electric vehicles. Regarding Safran Landing Systems, the Querétaro (Mexico) site's main activity is the production of landing gear fittings for Airbus A320, the main landing gear bogie beam for the A330, and the inner cylinder of the Boeing 787 nose landing gear. Its creation consolidated Querétaro's area, a hub for the aviation industry in Mexico.

The students had the opportunity to learn about the production processes at both companies and the importance of the variables in the heat treatment processes, such as the austenitization temperature, quenching media, temperature control for the furnace, and different techniques for metallographic characterization.

29 students attended a plant tour to Metalinspec Laboratories at San Nicolas de los Garza, Nuevo León. Metalinspec Laboratories provides solutions to the industry through testing of different materials and products, using state-of-the-art facilities, and based on a quality system accredited under the international standard ISO 17025. The students had access to different equipment to develop mechanical testing and metallographic preparation.

3.- Experimental preparation and heat treatment of automotive steels (January to May 2026)

During the first year of the project, the aim is to evaluate the mechanical properties of SAE 9254 and SAE 8620 steels subjected to quenching in a 10% and 20% alkylene glycol (PAG) solution and quenching oil under moderate stirring at 25 °C. The specimens were cut and machined into specimens of 15 mm in diameter and 60 mm in length (simulating the conventional measurements of the wire rods and, in the same way, guaranteeing the radial heat transfer in the specimen); a 1/8" K-type thermocouple (Chromium-Alumen) was placed in the center of the specimens, to acquire the thermal histories during the heat treatments.

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The specimens were heated to 870 °C and held at this temperature for half an hour before being quenched in the PAG solutions. The probes were sectioned and tempered at 200 °C for 1 hour to evaluate the effect of PAG concentration on microhardness.

4.- Participation at Emerging Professionals competition and MS&T 2026

ASM International organized the Emerging Professionals competition at Monterrey, Nuevo León, in April 2026, where students from various universities across Mexico took their academic work to an international stage during the Heat Treat Mexico 2026 event hosted by the Society for Heat Treatment and sponsored by Fluxtrol, Inc.

Manuel Alejandro Bucio Sevilla won second place with his project, "Quenching and Tempering Process of SAE 9254 Steel Using Aqueous Polyalkylene Glycol (PAG) Polymer," presenting part of the work developed in this project.

Beyond the award, this experience gave all participating students the opportunity to present their research to representatives from international companies such as Fluxtrol, Inc., Quaker Houghton, ECM Mexico, and Grupo FOREM, who evaluated both their technical knowledge and communication skills.

By now, 4 abstracts have been accepted in the MS&T 2026 Technical Meeting under the Advances in Ferrous Metallurgy Symposium, organized by AIST.

The abstracts accepted are:

- Effect of Oil Temperature on Cooling Rates during Quenching for AISI 8620 Steel
- Quenching and Tempering Process on SAE 9254 Steel Using Aqueous Polyalkylene Glycol (PAG) Polymer
- Effect of Polyalkylene Glycol (PAG) Concentration and Agitation on Cooling Rates and Hardness of AISI 9254 Steel
- Effect of Agitation on Oil Quenching of AISI 9254 Steel

The students involved in the projects are

- Manuel Alejandro Bucio Sevilla
- Janeth-Guadalupe Anguiano-Garcia (Steel Intern Scholar 2026 by AIST Foundation)
- Diego Viveros-Zavala
- Juan Carlos Vilchez-Pedroza
- Emmanuel Lozano Maldona (Steel Intern Scholar 2025 by AIST Foundation)
- Sofía González Espinosa (Steel Intern Scholar 2026 by AIST Foundation)

Dissemination of Results:

- Hierro & Acero magazine from AIST Chapter México (<https://aistmexico.org.mx/hierro-y-acero/>)
- LinkedIn post (<https://www.linkedin.com/in/monserratlopezc/>)
- YouTube Channel (<https://www.youtube.com/@dramonselopez>)
- Advanced Materials & Processes Magazine (<https://static.asminternational.org/amp/202605/42/>)
- Emerging Professionals competition, ASM International, April 14-16, 2026. Monterrey, Nuevo León.

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Project Schedule:

Month	Activities	Students Involved
July 2025	EQUIMSA - Especialidades Químicas Training Session	5
September 2025	TREMEC and Safran Landing Systems plant tours (Querétaro, México)	25
October 2025	Attendance at Heat Treat 2025 in Detroit, Michigan	2
December 2025	Metalinspec Laboratories plant tour	29
January 2026	Specimen preparation: machining of cylindrical samples and instrumentation	5
February to April 2026	Heat treatments in automotive steels using alkylene glycol (PAG) solution.	7
April 2026	Attendance at Heat Treat Mexico 2026 in Monterrey, Nuevo León.	2

Project Cost:

Item	Details	Unit Cost (Dollars)
Machining Services	Coolant and drill bits for 30 steel specimens	200
Heat Treatment supplies	Furnace maintenance, ceramic fiber for insulation, 15 Type K Thermocouples, and SAE 8620 and SAE 9254 steel bars.	2000
ATK- 600 Mitutoyo hardness tester	A testing machine that can perform 2 hardness tests, Rockwell and Rockwell superficial.	4200
Student Scholarships	Considered for travel expenses	3000
Plant Tour to Safran Landing Systems and Tremec	Lunch for 29 students attendance	600

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Student Participation:

- The activities reported during this year impacted more than 50 students.
- 3 undergraduate students participated in Heat Treat 2025 and Heat Treat México 2025, organized by ASM International.
- 5 undergraduate students from the Materials Engineering department participated in technical training in heat treatments by the company EQUIMSA Especialidades Químicas Monterrey.
- 7 undergraduate students are part of the research team focused on heat treatments.

Steel Plant Interaction

- 59 students attended the 3 different plant tours.
- Instituto Tecnológico de Morelia formalized alliances with Metalinspec and EQUIMSA Especialidades Químicas Monterrey in order to promote summer internship programs, technical seminars, and plant tours.

Project Duration: 10 months (from July 2025 to May 2026)

How many students from this university have accepted employment in the steel industry upon graduation?

1. Isabel Bucio Herrejón joined Instron (Metalinspec).
2. Valeria Villagomez joined Ternium México.
3. Maria Mercedes Pérez-Padilla joined Ternium México.
4. Marco Silverio Morales joined Ternium México.
5. Adriana Lozano García joined Ternium México.
6. Karla Márquez Piñon joined Ternium México.
7. Dominic Tello joined Ternium México.
8. Diego Viveros joined TYASA.
9. Cristian Rodríguez joined Grupo Acerero.

Future of Grant:

- ☒ I have just completed year **ONE** of the three-year grant.
- ☒ I hereby confirm that the plan contained in my original proposal will continue during the next academic year and request funding (US\$10,000/Year 2, or US\$5,000/Year 3) to continue the Steel Curriculum Development plan as submitted in my original proposal.
- ☐ The plans contained in the original proposal are now complete. I have \$_____ remaining and request permission to continue promoting the steel industry to engineering students at my university using these funds. I agree to provide an annual report to AIST until the funds are depleted.
- ☐ The plans contained in the original proposal are now complete. I agree to the final results being posted to the website, shared with other universities, shared with AIST members, added to the AIST Library, or presented at a conference.

Signature of Professor and Date

Monserrat Sofia López C
06/10/2026

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