ASM HEAT TREATING SOCIETY

Strong Bar Student Competition

October 17-19, 2023

During Heat Treat 2023 – Detroit, Michigan

OVERVIEW

Goal:
Student teams will heat treat steel bar to achieve the highest combination of bending strength and bend deflection.

Description:
Four cold drawn cylindrical pieces of 9254 spring steel will be provided by the ASM Heat Treating Society to each team (only one complete sample must be submitted for testing at Heat Treat 2023; three samples are for experiment and analysis). Teams will heat treat the specimen according to their best choice and bring the heat treated cylinders to Heat Treat. Teams will provide a poster that describes their heat treatment method, the hardness profile, and microstructure. The bars will be tested in bending by MTS on the exhibit floor to determine the winners.

Deadline:
Registration closes March 1, 2023, but act soon because only 10 teams will be accepted. Secure your spot today by completing the form linked below:
https://forms.office.com/r/sty1tDba2f

Eligibility:
College student teams (Material Advantage or other) are invited to participate.

RULES

1. The competition is open to all full-time students pursuing graduate or undergraduate degrees who are ASM/Material Advantage members. Not yet a member? Join by clicking here.
2. Each team must have between 2-5 members. The team members must be from the same university, and each participant can only be on one team. Teams will design and execute a heat treatment for a 9254 steel bar to achieve the highest combination of bending strength and bend deflection. Hardness must exceed 50 HRC (515 HV).
3. Each team will be supplied with 4 samples of 9254 steel bar with dimensions 10.4 mm diameter and 100 mm length. The chemical composition will be provided with the samples. Teams must provide a mailing address for delivery of the samples.
4. Three samples can be used for experiment and analysis. One sample must be delivered to at an exhibit booth (to be announced) at Heat Treat 2023 for bend testing on site.

a. Experiment/analysis samples: these should be used to validate your recipe. Samples should be taken to determine cross-section hardness and microstructure of your heat treated sample, and these results will be included in your poster.

b. Bend Test sample: Your test sample must be prepared and submitted to an onsite exhibit booth (to be announced) to do the bend test event at Heat Treat 2023. The actual poster judging and testing dates will be provided with the test specimens.

c. Specimens will be tested in bending to determine the load versus deflection up to failure. The primary measure will be the peak load. Extra credit (5% of peak load) will be given for ductility measured as non-linear deflection/load beyond the peak load.

5. Project teams are responsible for transporting their steel bar and poster to Heat Treat 2023.
6. Teams must have a faculty/staff advisor who is a member of ASM.
7. No substitute materials are allowed. The method of heat treatment is to be determined by the teams.
8. Each team must present a poster with test results from the first 3 samples as well as the final Heat Treat Process and explanation of the expected and actual results (microstructure, mechanical properties).
9. A minimum of one team member must be present for the entire competition and judging at Heat Treat 2023.

CODE OF CONDUCT (Labor Guidelines)
-1. Team Advisor may not perform any labor.
-2. Anyone outside of the team, including Team Advisor, may not assist in heat treatment or design of process.
-3. Use of special equipment that is not available for students to operate may be outsourced to another person at the university. This choice must be defended in the poster presentation, and the external person must be credited as well as not perform more than 30% of the labor hours on the project. It is preferable that the team performs all labor.

Supplies:

- ASM-HTS will provide students with 4 samples of steel bar. All 4 samples are identical, and can be used so that students have 3 practice pieces and 1 “submission” piece (to test at Heat Treat 2023). All specimens are provided by Nucor steel from a single batch of cold drawn material so that all students start with the same dimensions, alloy and prior microstructure.

Equipment:

- Students must have access to lab-scale heat treat furnace and lab-scale quenching (i.e. a bucket).
- Access to metallography lab for analysis of samples.
- Access to mechanical testing for hardness testing.

<u>Rubric/Points</u>
50% Bend test results at Heat Treat 2023.
15% Poster including research to decide heat treatment method.

10% Actual heat treatment of bend test specimen described in poster.
25% Hardness traverse and metallographic evaluation of the sample presented in poster.