Rules for Strong Bar Competition

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 4140 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 4140 steel bar with dimensions 9.5 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 at IMAT 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 Instron at their booth in the exhibition one day prior to the bend test event at IMAT. A 0.5 mm deep circumferential notch will be machined in your test specimen at the exhibition prior to testing.
   c. Specimens will be tested in bending by Instron at the expo to determine the load versus deflection up to failure. The primary measure will be the peak load. Extra credit 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 IMAT (ASM’s Annual Meeting).

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 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 IMAT.

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 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 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 IMAT). All specimens are provided by Nucor steel from a single batch of material so that all students start with the same 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 and analysis of samples

Rubric/Points

50% Bend test results at IMAT
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.

Bob Cryderman
4/8/2020