

# ***Austen Nite Materials***

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Students  
Materials Science Laboratory  
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Dear Students,

I am requesting your assistance in determining the hardenability of three different steels (AISI/SAE 1045, 4140, and 4340). Please conduct Jominy end quench testing per ASMT A255 -*Standard Test Methods for Determining Hardenability of Steel*.

When conducting this work, please think about the hardening (strengthening) mechanisms involved. Last week, we studied precipitation hardening (aka aging) of 2024 aluminum alloy. The process of precipitation heat treating (heating, quenching, re-heating) has similarities with the processes of heat treating steel. However, these processes affect aluminum and steel ***very differently!*** Remember, the aluminum alloy was strengthened (as indicated by increased hardness) due to controlled diffusion during the aging process. This resulted in second phase structure ( $\theta = \text{theta} = \text{CuAl}_2$ ) precipitating within the  $\alpha$  grains ( $\alpha$  being FCC aluminum with small amounts of copper dissolved as a substitutional impurity). Very very different mechanisms are at work with heat treating of steel! Remember the terms austenite ( $\gamma$ -iron),  $\alpha$ -ferrite, cementite, martensite, pearlite, etc.? Those describe microstructures and/or phases in steel, not aluminum alloys! Understanding how those structures are formed in steel and their effect on mechanical properties is very important!

Two things are due next week:

- 1) As a team, for your Independent Lab experiment:
  - a) Revise the background and procedures per instructor feedback.
  - b) Create a blank data sheet for your experiment. As examples, consider the data sheets provided to you before each lab we've done this semester and see links on the course web page for further details and help.
  - c) Submit the previous Independent Lab work that contains instructor feedback/comments.
- 2) Each student is to complete the worksheet handed out in class for the Jominy test.

Thank you for help in this matter. If you have further questions, do not hesitate to call me at 943-7432, or email at [lulay@up.edu](mailto:lulay@up.edu).

Sincerely,  
*(electronic)*

Kenneth Lulay  
Austen Nite Materials

Enclosed: three (3) Jominy test specimens; AISI/SAE 1045, 4140, 4340