Potential Quiz Questions

QUIZ 1 (Calibration, standards, strain gages, tensile testing, c/w and annealing)

Calibration, Standards (refer to the ME Laboratory booklet)

In order to have confidence in measurements, the measuring device should be: a) less than 10 years old; b) calibrated and certified; c) be guaranteed by the manufacturer to be accurate

Calibration is the process of estimating a measuring devices uncertainty (error) compared to known (true) value. True/false

Standardized tests: a) help assure validity of testing; b) help communication regarding test procedures; c) helps prevent "reinventing the wheel"; d) allows for availability of standard test specimens; e) all of the above.

Strain Gages

A Wheatstone bridge circuit is used in the strain indicator because: a) it is unaffected by temperature changes; b) a small change in resistance will produce a measurable voltage changed; c) Wheatstone bridge circuits can measure very small electrical currents.

What is the characteristic of the gage that relates change in resistance to strain: a) gage factor; b) gage number; c) strain number; d) R to E ratio

Tensile Testing

Cold rolling AISI 1045 steel decreases the strength (compared to hot rolled): true, false

A "reasonable" strain in an aluminum test specimen near its yield strength would be:
a) 0.0048 in
b) 0.0048 in/in
c) 48,000 psi
d) 48,000 ksi

In a standard tensile test, the ultimate tensile strength is equal to: (*define*)

Young's Modulus (Modulus of Elasticity) of aluminum is: a) less than steel, b) about the same as steel, c) greater than steel

Which of the following properties cannot be obtained from a stress-strain curve: a. Young's modulus; b. Poisson's ratio; c. yield strength; d. tensile strength

Cold Working and Annealing of Copper

The "recovery" process that occurs during the annealing: a. decreases the number of dislocations; b. increases the number of dislocations; c. has no effect on dislocations

Annealing strain hardened copper causes it to: a. get harder; b. get softer; c. does not change hardness

Strain hardening causes dislocation density to: a. increase significantly (creates dislocations); b. decrease significantly (annihilate dislocations); c. not change significantly

The rate of recrystallization and grain growth during annealing: a. increases as temperature increases; b. decreases as temperature increases; c. is not affected by temperature

QUIZ 2: (HT of alum, Jominy end quench and HT of steel)

Precipitation Heat Treating of Aluminum

Are all aluminum alloys heat treatable (i.e. can they all be precipitation heat treated)?

Precipitation hardening of 2024 aluminum results in finely dispersed precipitates that: a. facilitate the motion of dislocations; b. impede the motion of dislocations; c. have no effect on the motion of dislocations.

After quickly quenching 2024 aluminum alloy from solution heat treating temperature (~1000°F) to 35°F, the alloy will: a. be softer compared to pre-heating hardness (as received T351 condition); b. be harder compared to pre-heating hardness (as received T351 condition); c. have precipitates form; d. both b and c

The first step in precipitation heat treating of alloys such as 2024 aluminum is: (*name*)

Engineers need to be cautious when using precipitation hardened alloys at elevated temperatures because: a. they are more susceptible to creep; b. they can overage and hence become weaker; c. they have low melting points

For this lab, we started with 2024-T351. What does the 2024 refer to specifically? What does the T351 refer to specifically? 2024: T351:

Briefly describe what overaging is.

Describe the microstructure of 2024 aluminum alloy during the following:
-during solution heat treat
-immediately after quenching from solution heat treat
-after precipitation heat treating

Jominy End-Quench and Heat Treating of Steel

Tempering of martensite is typically carried out above the eutectoid temperature: true, false

AISI 4140 steel nominally contains: a) 40% carbon, by weight; b) 0.40% carbon, by weight; c) 1.40% carbon, by weight

Rapidly quenching AISI 4140 steel from austenite (above about 1600°F): a. causes it to get softer compared to "hot rolled"; b. causes it to get harder compared to "hot rolled"; c. causes precipitates to form

AISI 4140 steel is more hardenable than AISI 1040 steel because: a. the chromium and molybdenum in 4140 steel inhibit dislocation motion; b. the chromium and molybdenum in 4140 steel inhibit carbon diffusion; c. the chromium and molybdenum in 4140 steel increase thermal conductivity

AISI 1040 steel will be harder than AISI 1018 steel after they have been austenitized and quenched primarily because: a. there is more carbon in AISI 1040; b. AISI 1040 is more hardenable; c. AISI 1040 quenches more quickly than AISI 1018; d. none of the above.

Slow cooling AISI 1040 steel after austenitizing typically results in: a. a mixture of proeutectoid ferrite and pearlite; b. a mixture of proeutectoid ferrite and bainite; c. martensite

AISI 1018 steel may be precipitation hardened: true false

QUIZ 3 (microscopy, welding, Charpy Impact, Residual Stress)

Microscopy and welding:

Welding a highly hardenable steel will likely result in martensite being formed in the weld region. True/False

Welding a heat treatable aluminum alloy (meaning it can be precipitation hardened) will result in the weld and heat affected zone being harder than the base metal. True/False

A heat treatable aluminum alloy (meaning it can be precipitation hardened, for example 2024-T351), when welded, may result in microstructural changes in the heat affected zone that would likely a) be softer; b) be harder; c) be same hardness…than the base metal.

Pearlite, spheroidite, bainite, and tempered martensite are all composed of two phases: α-ferrite and cementite. True/False

Martensite is a metastable phase composed of α-ferrite and cementite. True/False

The properties of a metal are affected by: a. composition of each phase; b. phases that are present; c. phase morphology (morphology includes shape, size and distribution of phases); d. all of the above

The ability of a microscope to distinguish between two closely spaced features is referred to as: a. resolution; b. magnification; c. neither a nor b

An electron microscope can have far better resolution than a light microscope because: a. Electrons are larger than photons; b. Wave length of electron beams can be much shorter than optical light waves; c. Electrons may have lower energy than photons

The microstructure of a metal may be identified by using a light microscope. True/False

The crystal structure of a metal may be identified by using a light microscope. True/False

The eutectoid composition of plain carbon steel is about 0.8wt%C. If the microstructure of a plain carbon steel is about 25% proeutectoid ferrite and 75% pearlite, its carbon content is: a. about 0.2wt%C; b. about 0.4wt%C; c. about 0.6wt%C; d. about 0.8wt%C.

An SDS (Safety Data Sheet), formerly MSDS (Materials Safety Data Sheet): a. contains potential health hazards of the chemical; b. contains the manufacturers name; c. must be available for all employees; d. all of the above

Charpy Impact Testing

The reason the aluminum alloy did not show a ductile to brittle transition was because: a. it has low density; b. the FCC crystal structure allows dislocations to freely move at low temperature; c. the strain energy produced by precipitation hardening improves toughness

The reason many metals exhibit a ductile to brittle transition is because: a) most metals develop a brittle microstructure at low temperatures; b) diffusion decreases with temperature, and since effectively dislocation motion can be considered a form of diffusion, their ability to move decreases at low temperatures; c) low temperatures increase the cold rolling characteristics of a metal.

The reason dislocations are able to move through metals with FCC crystal structures easily even at very low temperature is because:

a) FCC has the highest possible planar atomic density
b) FCC has the highest possible linear atomic density

c) Both a and b

Increasing carbon content in plain carbon steel: a. decreases the ductile to brittle transition temperature, b. increases the ductile to brittle transition temperature, c. has little effect on the ductile to brittle transition temperature

Cold worked steel compared to hot rolled will be: a. tougher, b. less tough, c. no difference in toughness

Metals composed of what crystal structure do not exhibit ductile to brittle transition: a) FCC; b) BCC; c) BCT

Residual Stress

Generally, compressive residual stresses on the surface: a. are usually desirable; b. are usually undesirable; c. can not determine if they are desirable or not.

Residual stresses may be caused by: a. phase changes; b. plastic deformation; c. manufacturing processes; d. all of the above

At times, manufacturing processes are used to intentionally introduce residual stresses into a part. True/False

At times, thermal treatments are used to intentionally reduce residual stresses True/False

Welding can produce residual stresses exceeding 75% of the yield strength of the material True/False