Purpose and Scope

- The purpose of this work was to determine basic mechanical properties of AA 6061 aluminum alloy in the O, T4 and T6 tempers.
- These properties include the elastic modulus, the 0.2% offset yield strength (YS), the ultimate tensile strength (UTS), and the elongation.
- Constitutive equations in the plastic region, using true stress and strain, were also determined.
- Tests were performed at an initial strain rate of 0.01s\(^{-1}\).
- Comparisons between the tempers are made.
- A computer controlled Instron model 5567 tensile test machine and extensometer were used for this work. All data were obtained via the systems computer data acquisition system.

Method

- A computer controlled Instron model 5567 tension/compression testing machine and 1 inch extensometer were used for these tests.
- Three specimens were tested, one for each condition, O, T4 and T6 tempers.
- The specimen geometry consisted of a 1.25 inch long gauge section with a diameter of 0.250 inch.
- 1 inch gauge marks were place on the samples to determine elongation after fracture.
- The tests were performed at a cross head speed of 0.0125 in/s, which provided an initial strain rate of 0.01s\(^{-1}\).
- The uncertainties for all measurements are provided in Table 1.

Results

- Figure(s) of engineering strain versus engineering stress, indicating the 0.2% yield strengths.
- Figure(s) of true strain versus true stress with power-law hardening equations for each data set.
- Figure(s) of engineering strain versus engineering stress. Use the cross-head position data (aka “Extension”) to calculate engineering strain, neglecting machine compliance.
- Compare the results from the three tempers. Consider some questions to guide you.
  - Can elastic modulus be accurately determined for each data set?
  - Are there any significant differences in elastic moduli?
  - Which temper exhibits the highest strengths, the greatest ductility? Why?
  - How do the T6 and T4 tempers achieve their strength when compared to the O-temper?
  - Which temper exhibits the most strain hardening? Why?
  - To which temper is the power-law hardening relationship best suited? Why?
- Compare data to textbook and/or handbook values.

Conclusions (you are not limited to just these)

- The purpose of this work was to...
- Make conclusions about mechanical properties:
  - With respect to the changes in properties due to heat treatment.
  - Indicating the highest strength and highest ductility conditions.
  - Regarding elastic and plastic properties compared to textbook values.
- Make conclusions about the dominant strengthening mechanism for each temper related to the results.
- Make a conclusion regarding the nature of elastic and plastic material constants.
- Others as appropriate.

Recommendations

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