Effects of temperature on toughness and fracture surface appearance of a36 steel ...

Environment, Water

Problem statement

The knowledge on how materials behave or fail when subjected to different conditions is of critical importance in the engineering field. This knowledge will ensure that there is appropriate selection of material for diverse working conditions. Thus, it is paramount to establish the features that are associated with unique classification of material. In this experiment, the behaviors of A36 steel and the aluminum when subjected to impact loading are investigated. To compare these two materials, the amount of energy required to break a respective piece are compared.

Procedure

Equipment: Tinius Olsen machine, Pair of thongs

Material: A36 steel and the aluminum samples, Boiling water, Dry Ice

In order to achieve the objectives of this experiment, several samples of A36 steel and the aluminum were tested on Tinius Olsen machine. The machine has a heavy pendulum and supports for holding the samples in the Charpy test as outlined in the diagram below (ASTM Standard 43).

- Test samples were placed onto dry ice, approximately -75°C and other samples to boiling water, approximately 100°C
- Tinius Olsen machine and the samples from dry ice using a pair of thongs were set up
- Pendulum was released and absorbed energy recorded the when the sample was fractured
- The 2nd and 3rd steps were repeated for samples in boiling water

Results

Conclusion

The results of this experiment show that temperature has a significant role in affecting material toughness. Whereas Aluminum showed minimal differences in ice cold, room temperature and boiling water temperatures, A36 Steel showed substantial decrease in its toughness alongside decrease in temperature as shown in the energy required to break the samples. With regard to the appearance of fracture surfaces, the A36 Steel surface became more and more distorted as temperatures rose because of the amount of energy required to fracture whereas the fracture surface in aluminum was smooth because of the retention of ductility notwithstanding changes in temperature (Callister and Rethwisch 34).

Works Cited

ASTM Standard E 23-07. Standard Test Methods for Notched Bar Impact Testing of Metallic

Materials. West Conshohocken, PA: ASTM International, 2007. Print.

Callister, William D., and David G. Rethwisch. Materials science and engineering: an

introduction. New York: Wiley, 2007. Print.