**Results**

Before beginning the experiment, measurements were made of the two types of test specimens that were to be used for Izod and Sharpe impact testing. Once these values were found, the error offsets of both the Izod and Sharpe impact testers were found by running engaging each of them with no specimens integrated in the machines’ test area and subsequently recording the difference in energy when the each machines’ hammer swung back to its original position. With these offsets in mind, the test procedure laid out in the Procedure was run, and the energy lost in impacting the Hot, Cold, and Room Temperature versions of each test specimen was found. All of these results have been summarized in Tables 4-1 through 4-3 below.

**Table 4-1. Test Specimen Dimensions**

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Specimen** | **Length (ft)** | **Width (ft)** | **Height (ft)** |
| Sharpe | 0.182 | 0.035 | 0.035 |
| Izod | 0.243 | 0.035 | 0.0-35 |

**Table 4-2. Impact Testing Machine Offsets**

|  |  |
| --- | --- |
| **Test Specimen** | **Energy Offset (ft•lbf)** |
| Sharpe | 3.25 |
| Izod | -5.5 |

**Table 4-3. Energy Absorption for Izod and Sharpe Impact Testing**

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Specimen** | **Material** | **Temperature** | **Energy Loss (ft•lbf)** |
| **Izod** | Aluminum | Cold | 12 |
| Room Temperature | 9.5 |
| Hot | 12.5 |
| Steel | Cold | 4 |
| Room Temperature | 65.5 |
| Hot | 63.5 |
| **Sharpe** | Aluminum | Cold | 15.5 |
| Room Temperature | 13.75 |
| Hot | 10.75 |
| Steel | Cold | 3.25 |
| Room Temperature | 25.5 |
| Hot | 26.625 |

**Discussion of Results**

With these values in mind, it was possible to calculate the work per unit volume associated with each impact test trial. This was accomplished by simply dividing the Energy Loss of each trial by the volume of the test specimen associated with it. The results of this process are listed in Table 5-1.

**Table 5-1. Work Per Unit Volume for Each Impact Test Trial**

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Specimen** | **Material** | **Temperature** | **Work Per Unit Volume (lbf/ft2)** |
| **Izod** | Aluminum | Cold | 40945 |
| Room Temperature | 32415 |
| Hot | 42651 |
| Steel | Cold | 13648 |
| Room Temperature | 220080 |
| Hot | 216668 |
| **Sharpe** | Aluminum | Cold | 70517 |
| Room Temperature | 62555 |
| Hot | 48907 |
| Steel | Cold | 14786 |
| Room Temperature | 116011 |
| Hot | 121129 |

From this data, once notes that the energy required to fracture the steel specimens was greater than that for the aluminum specimens, regardless of temperature or test configuration. This indicates that harder, stronger metals, such as steel, are harder to fracture than softer, more ductile materials, such as aluminum. However, just because a metal is hard does not mean that it is tough. For example, if a manufacturer were to dose a steel specimen with as much carbon as possible in an attempt to increase its strength, and thus, its resistance to fracture, he or she may end up with a product that is too brittle and thus more likely to fracture sooner than its more ductile, less-ferrous counterpart. Hence, in order to achieve material toughness, one must strike a balance between strength and ductility.

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