THE TENSILE AND IMPACT STRENGTH OF ANNEALED AND WELDED 5086 ALUMINUM DOWN TO 20°K

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Introduction

The aluminum alloy, 5086 (4.0 per cent Mg, nominal), which was developed for structural use and particularly for welded structures, has been found to be one of the strongest as well as one of the most ductile of the aluminum alloys. Because this alloy was expected to exhibit a higher strength but still retain most of its ductility at low temperatures, a program was undertaken which involved the testing of both the parent and welded metals down to 20°K.

The results of unnotched tensile tests includes the ultimate strengths and yield strengths (0.2 per cent offset), elongation, and reduction in area at four temperatures, 300°K, 195°K, 76°K and 20°K. Tests were also conducted on Charpy V-notch impact specimens at the same temperatures.

Preparation and Test Procedures

Impact and tensile specimens were cut from 3/16 inch aluminum plate which was butt-welded with 5183 aluminum welding rod in a 60° single V by the heliarc method. The welding was accomplished under a helium atmosphere in two passes. In all, three plates were welded using a constant applied voltage of 60 volts. Current for the three plates, however, was regulated at 65, 75 and 90 amperes, respectively.

The welded tensile specimen is shown in Figure 1. Note that the weld-bead was not removed. With the exception of the thickness which was 1/8 inch, the specimens of the parent metal had the same dimensions. The parent specimens were cut from an unwelded plate. The welded Charpy V-notch impact specimens were machined to A.S.T.M. specifications


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Figure 1. Welded tensile specimen

Figure 2

Figure 3. Annealed Al 5086, 200X

Figure 4. Annealed Al 5086, 200X