

APPLICATION NOTE

Welding of 5xxx to 6xxx Series Aluminum

Introduction

Automotive hang-on parts, which frequently incorporate aluminum, can present difficulties for laser welding. In particular, aluminum has a tendency to “hot crack” because the various alloying elements solidify at different temperatures, causing the still liquid components of the fusion zone to pull apart during the solidification process. Traditionally this has been solved using filler material that inherently adds cost and complexity to the process.

Process

The requirement was to join 5xxx to 6xxx series aluminum using a remote laser welding head. The use of a filler wire was not an option because remote welding heads are not compatible with wire feeders. For this task, we selected the HighLight FL-ARM fiber laser (Fig. 1) which enables independent control of ring and core beam power. The 0.2 mm core and 0.6 mm diameter ring laser beams were focused by the remote welding head at the edge of the top aluminum sheet. These sheets were 0.8 mm thick, and were welded at a processing speed of 5 m/min. The laser power in the ring was 1500 W and the core power was adjusted between 500 to 1000 W to allow penetration depth to be varied independently of weld width. The optimized beam configuration utilized allowed precise control of both pre- and post-heating, thus avoiding problems caused by rapid part cooling and eliminating the need for filler wire.

Results

The HighLight FL-ARM fiber laser has the proven ability to perform aluminum welding without the need for filler wire to eliminate hot cracking. The results and effectiveness of subtle changes in laser power distribution are shown in figure 3. Parts A and B show that by adjusting the beam intensity profile, the depth of weld can be controlled while keeping the weld width constant.

Application Field

Laser welding of aluminum for BiW applications using independently adjustable ring and center mode high-power fiber lasers.

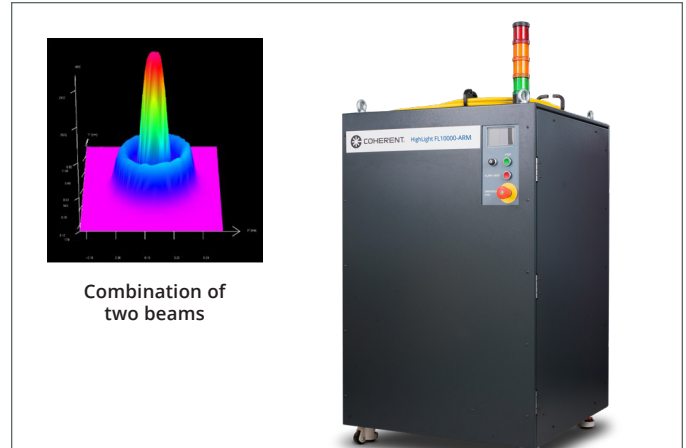


Figure 1. HighLight FL-ARM fiber laser

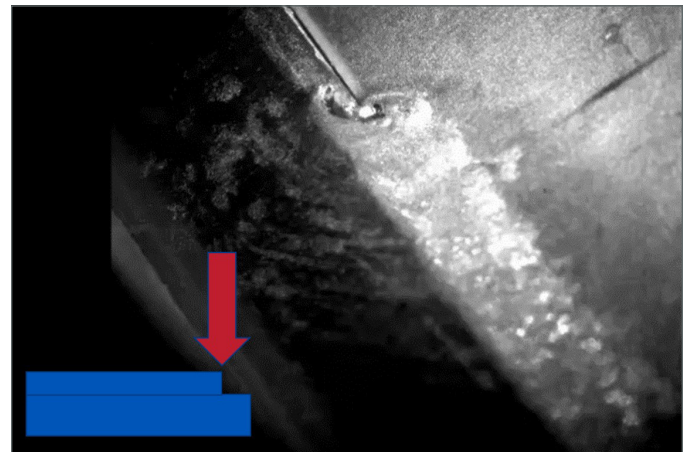


Figure 2. High-speed video screen capture of welding process using the HighLight FL-ARM fiber laser

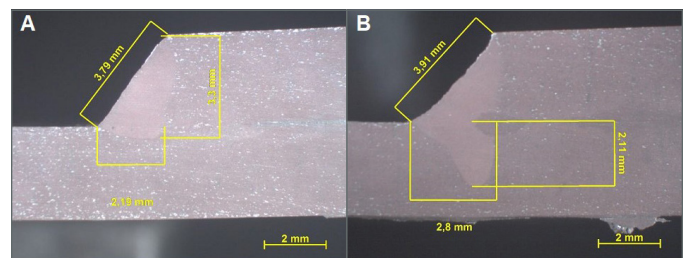


Figure 3. Cross-sections of aluminum welds using different center beam power levels

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