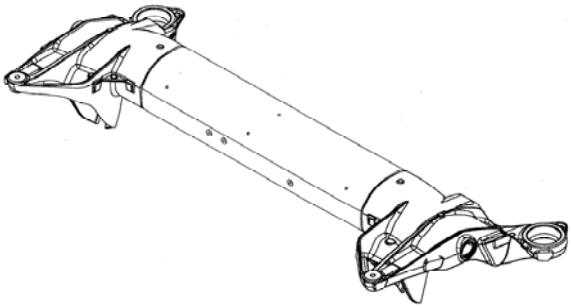
# CASE STUDY:
# LASER AND SHEET PROCESSES GROUP

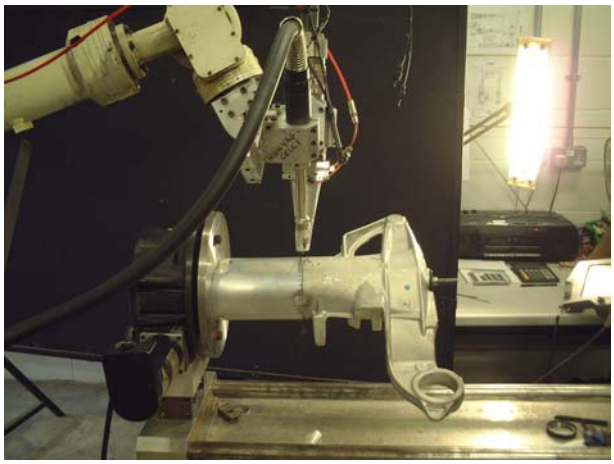
WORLD CENTRE FOR MATERIALS JOINING TECHNOLOGY

## Hybrid Nd:YAG – MIG welding of an aluminium rear axle housing component

The automotive industry is a fiercely competitive market that has embraced both laser welding as an alternative joining technique to resistance spot welding to increase productivity and drive down costs, and a change to aluminium as a low-weight alternative to steel, to produce more fuel-efficient components. One of the challenges of laser welding is to present the parts with as little a joint gap as possible, which is not always easy in a production environment. To address this, hybrid laser-MIG/MAG welding, whereby a laser beam is focused inside a MIG/MAG weldpool, has been investigated as an alternative joining process which relaxes the joint fit-up requirements whilst maintaining the productivity advantage that laser welding offers.



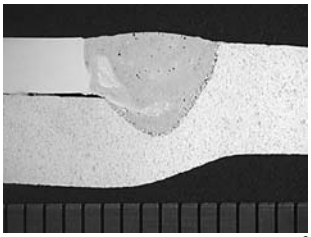
*Aluminium rear axle housing component*



*Robot mounted hybrid Nd:YAG laser – MIG welding set-up with component underneath in rotary manipulator*

TWI was asked to investigate the potential of hybrid Nd:YAG laser – MIG, for the welding of an aluminium rear axle housing component that comprised an extruded aluminium centre-section and two cast end-sections. MIG welding had been used to date, after press-fitting the 6000-series aluminium extrusion onto the silicon castings. For a fixed wheelbase distance, the manufacturing tolerances on the component parts meant variable joint gaps ranging between 1 and 4mm had to be accomodated by the welding process. An Nd:YAG laser was used, with the beam focused on and perpendicular to the material surface, followed by a standard MIG torch, arranged at angle of 30° to the laser beam centre line. The 4mm thickness self-supporting butt joints were welded in the PA position, with the non circular components rotated underneath the robot-manipulated hybrid welding arrangement, using 3kW of laser power and the MIG arc operated in the pulsed mode.

A four-fold improvement in productivity was achieved, i.e. a welding speed of 2m/min instead of 0.5m/min, with a weld quality at least as good as that resulting from the currently used MIG process. The hybrid Nd:YAG laser – MIG process was capable of bridging joint gaps as large as 4mm without compromising the weld quality.



*Transverse cross-section of a typical weld. Scale in mm.*

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