

IIW Graz, July 2008
Report on Meetings of Commission IV “Power Beam Processes”,
Commission III “Solid State Welding” and other Commission’s
Attended.

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Section 1.0 Report on the Technical Sessions.
Section 2.0 Overview.

1.0 Technical Session Report.

1.1 Monday, July 7th.

Morning Session Commission III

The first morning session began with the usual housekeeping formalities followed by several papers, the majority of which were concerned with:

- Friction Surfacing
- Friction Stir and Spot Welding applications.

The friction surfacing paper was concerned with overlaying carbon steel onto E 316 austenitic stainless steel pipe. While it was interesting, no clear applications were presented.

The stir and friction papers concentrated on high strength steels for automotive applications and friction stir welding of 6016 and 6061 aluminum alloys. The paper presented on the friction stir welding of 6061 focused on a complex residual stress analysis.

All the papers in this session presented mathematical and graphical data which was both difficult to understand and decipher from the visual presentations. The focus was seemingly more research than application based.

Afternoon Session Commission IV

The meetings began with the Chair presenting the three day agenda, opening a discussion on “Power Beam” articles for “Welding in the World” and general house keeping matters.

Several, very interesting papers were presented with the following themes.

- The welding of Duplex Stainless Steels with straight laser and laser hybrid.
- The application of laser to mass gear production in the automotive industry
- Laser pressure welding of coated steels and aluminum.

Of most interest was the possible use of laser welded duplex stainless steels for bridge construction. Ongoing work was supported by ERF (European Research Funding), the objective being to take advantage of the stainless for strength and corrosion resistance and thus produce durable structures with less maintenance costs.

Joints between the deck plate and trapezoidal stiffeners were investigated and compared with similar joints produced by the SAW process. The data presented showed increased production with a laser-GMAW hybrid system whilst producing the expected reductions in distortion.

The known problems with autogenous welds regarding the ferrite-austenite balance in the final weld metal were addressed by the GMAW with filler. Results were still not optimal as the objective of obtaining 30-35% austenite in the fusion zone could not be achieved. More work on the dilution effects was planned.

The balance of austenite-ferrite in duplex autogenous welds is well known and thus LW and EBW are not generally recommended for this application.

While the option of adding filler by the LW-GMAW hybrid process is one method of approach, others have approached the problem by stirring and re-heat treating the weld by the use of de-focused beams. Papers presented on this topic were in the pure research vein as the use of up to 14 de-focused rotations on one application would not be a technique readily adopted at the production level.

1.2 Tuesday July 8th

The morning was split between Commission III and a Joint Workshop of Commission IV and XII.

Commission III

The early papers in this session were focused on quality viz.:

- The “state of the art” in the quality management of resistance welds
- Spot weld thermal expansion and its relationship to weld quality.

The first paper was presented using a lot of math and statistics and was relevant to the fabrication of aluminum and high strength steel car bodies and attempts to reduce weight by aluminum use, control of weld nugget size etc and the use of numerical modeling.

The spot weld paper was of interest in its focus on the so called “corona” which is a property of the spot weld nugget. The presenter had used focused ultrasonic probes to identify this corona which was related to the thermal properties of the nugget.

Each of these papers were presented by Japanese researchers, the nation seemingly spending lots of time and money on solid state welding which is naturally focused on their automobile sector.

Joint Workshop of Commission IV, XI1 and SG 212 on the “Effect of Flux and Shielding Gas in Arc, Laser and Hybrid Welding”.

The joint session was joined to hear a paper entitled “Laser-GMAW Hybrid with Three Arcs”. The paper was aimed at the auto sector again, in particular a Daimler Feronius hook up. The information presented concerned a laser followed by two GMAW arcs. Since the material welded was high strength steel, the paper concerned itself with controlling the cooling rate between T 800-500 degrees C in order to control the microstructural properties of the weld zone.

1.3 Tuesday Afternoon and Wednesday, July 9th

Commission IV.

Commission IV activities attended in the final hours of meetings revolved around laser welding of duplex stainless steels, electron beam welding of high carbon tool steels and laser hybrid applications in general.

The general application of lasers and the EBW presented information which was felt to be not really new, however, the papers presented by the Avesta, Sweden and the Federal Institute for Materials Research, Berlin on duplex/laser/hybrid welding where excellent, packed with information and really well presented.

The major topic was the welding of 12.5 mm 2205 duplex in a single pass with a 14 KW fiber laser-GMAW (Ar-1% Oxygen shielding mix) hybrid. Nickel foils of 50-150 micro meters added to the joint were studied. The foils were to promote the formation of austenite in the weld zone.

The work is currently ongoing and will be reported during the coming year. Contact was made with some of the principal authors.

2.0 General Overview of Sessions Attended.

The power beam sessions were well attended and were generally very good sessions with lots of questions. Now that the hybrid laser welding technology is beginning to get off the ground in Canada it is felt that the meetings are important in keeping us up to date with ongoing developments, principally in Europe.

Electron Beam is being used in Canada, principally in the nuclear and aerospace fields for joining materials that need to be welded in absence of the atmosphere. e.g. zirconium and titanium alloys. It is felt that the EBW technology itself is quite mature from the equipment side; the metallurgy is perhaps the bigger challenge with the welding of super alloys and it is believed this is being looked at by the Aerospace Institute/NRC in Canada.

As mentioned earlier, hybrid laser (LW-GMAW) may be the coming thing for pipeline steels and for various types of stainless, in particular the duplex alloys. This advent of this dual process technology is significant and needs to be kept abreast of through this forum. There is already one organization researching its use in Canada for pipeline use, although for a US client.

Conversely, the Commission III technical papers were difficult to follow and the forum seemed to be dominated by Japanese researchers and the Japanese auto sector. At future meetings, it may be more beneficial to have a friction, solid state expert from Canada attend. This could perhaps be from the Bombardier Land Division or a supplier such as Magna with the author of this report attending meetings more closely associated with arc welding technologies and their metallurgy.

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September 2nd, 2008.