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INCREASE PENETRATION OF WELDMENT OF STAINLESS STEEL BY ACTIVATED TIG (A-TIG) WELDING

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Abstract: - A novel variant of TIG welding process called the A-TIG welding process involves application of thin coating (10-15 µm thick) of activated flux on the joint area prior to welding and the process is found to produce dramatic increase in penetration of 300% in single pass welding. A-TIG welding process has been found to overcome the limitations of the conventional TIG welding process. Here we developed A-TIG welding process for austenitic stainless steels and alloy steels and the technology.

Keywords: Penetration, Welding Process

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INTRODUCTION

In the last some years an enormous market stainless steels demand appeared .It is usual when we say "stainless" we mean "austenitic stainless steel" as the 80-90% of the total stainless steel production and consumption is austenitic. The advantages of austenitic stainless types are very well known.

The ATIG welding is the high productivity variation of the conventional TIG welding. When applying this hardly known welding process, the welding may be executed with substantially lower welding current and higher welding speed while the penetration is 2-3 times deeper as it is with conventional TIG welding. When ATIG welding is applied for welding of stainless steels the following rules must be kept:

- ATIG welding is applicable without bevelling. This decreases the cost and time of production and let the end-user easier fitting;
- Gap is not recommended when fitting the pieces, because it increases the possibility of porosity;
- One size bigger tungstan electrode should be used to resist the higher reflected heat;
- Electrode sharpening should be around 45º for longer life expectancy;
- Consistent active flux portioning is indispensable;
- Welding consumable is not added to the weld pool.

EXPERIMENTS:

Figure 1 shows schematically the differences between the TIG and A-TIG welding processes.

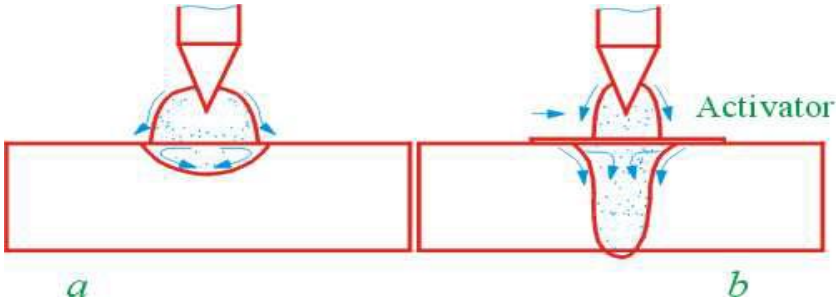
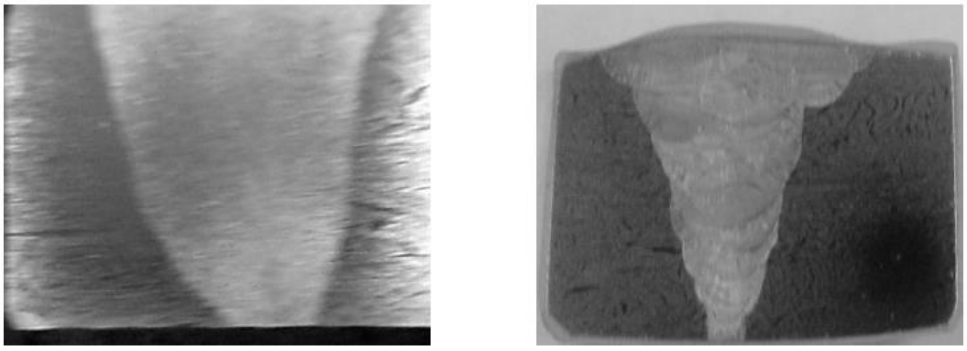


Fig. 1 Schematic sketch of (a) TIG and (b) A-TIG welding processes

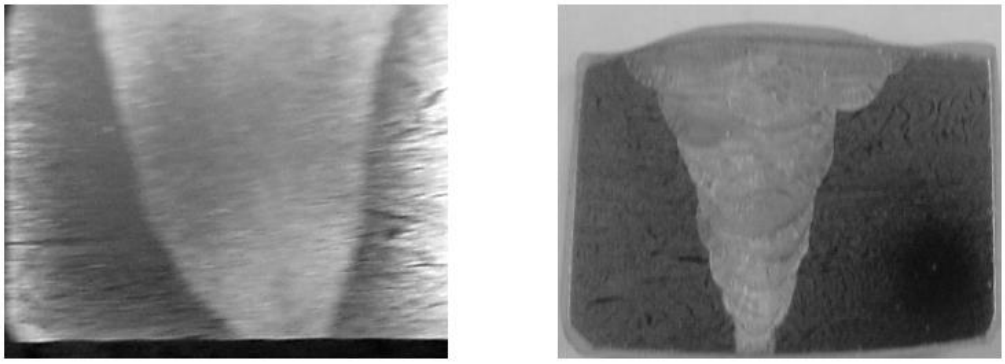
Figure 2 shows the cross sections of the 304LN stainless steel welds produced by A-TIG and multi-pass welding. It shows complete penetration for the joint thickness of 10 mm.



(a) **(b)**

Fig. 2 Cross-sections of the type 304LN stainless steel weld (10 mm thick) produced by (a) A-TIG welding (b) Multi-pass TIG welding

Multi pass weld on 10 mm thick 304LN stainless plates with V-groove was produced using conventional TIG welding with 308L filler wire. Ten passes were required to complete the weld joint. The cross sections of the 316LN stainless steel welds produced by A-TIG and multi-pass welding is shown in fig. 3.



(a) **(b)**

Fig. 3 Cross sections of the type 316 LN Stainless steel weld (12 mm thick) produced by (a) A-TIG welding (b) Multi-pass TIG welding

It shows complete penetration for joining thickness of 12 mm produced by A-TIG welding. The multi pass weld on 316LN stainless steel was produced using 316L filler wire. Twelve passes

were required to complete the joint. The A-TIG weld joints produced were sound and passed radiographic examination without any defects. There was residual fused flux layer produced on the face of the A-TIG welds that had to removed using wire brush.

The use of activated flux was found not to cause any significant change in the chemical composition of the weld metals compared to that of the base metals. There was no degradation in the microstructure and mechanical properties of the A-TIG welds compared to that of the welds produced by conventional TIG welding. The creep rupture life of 316 LN A-TIG weld joints enhanced by 75% compared to that of the conventional TIG weld joints. This is a significant achievement and hence the activated flux developed in the present work has greater potential for use during the welding of structural components made of 304LN and 316LN stainless steels.

CONCLUSIONS

- A-TIG welding process enables single pass welding of higher thickness plates with higher welding speed and hence reduced heat input.
- Enhanced productivity and reduced consumption of filler wire
- Residual stresses are reduced significantly (more than 70%) in A-TIG weld joints compare to conventional TIG weld joints and the weld joints are distortion free.
- Significant improvement in creep-rupture life (more than 75%)
- Significant reduction in the cost of fabrication (more than 50%)
- Up to 25 mm thick plates can be welded using double side welding procedure
- with square edge preparation

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