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Cold Wire Addition in MAG Welding

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***Abstract*—*This work aims to present a variation of the conventional MAG (Metal Active Gas) welding process, with the addition of a cold wire fed by a slave torch in the molten pool promoted by the electric arc originated form the main wire. Comparisons were made between traditional MAG processes with only one energized wire and the MAG-CW (MAG with addition of a cold wire). The welding parameters used allowed the spray mode of metallic transfer and the stability of the electric arc. As a result, a comparison was made to analyze the deposition rate, profile, width and depth of the bead between the two processes.*
Keywords*— *Welding, MIG / MAG; MAG-CW; Double Wire; Cold wire; Metallic transfer, Slave torch.

I. INTRODUCTION

The MIG / MAG welding process was introduced in 1948. This process of joining materials is one of the most widely used in industrialized countries (Bohme et al, 1996)[1]. It is a process of fusion welding, which begins with the opening of an electric arc shielded by a gas (GMAW -Gas Metal Arc Welding). (Marques, Modenesi and Bacarense, 2011)[2]

In order to increase the productivity of welding processes as a whole, the double wire was first applied in 1948 in submerged arc welding. Later, in 1955, this idea expanded to the area of welding with shielding gas. (Michie et al, 1999)[3]. The variation of the traditional process was known as MAG-CW.

This study has as main point analyzing the increase of the rate of weld deposition maintaining the quality of the bead and improving the penetration profile in the MAG welding with the addition of a cold wire.

II. OBJECTIVE OF THE INVESTIGATION

The main aim of this investigation is to compare the difference in deposition rate between the traditional process and the process with cold wire. Analyze the penetration profile in the two situations and associate it with the convection movement of the liquid metal in the melting pool. Understand and analyze the phenomena of the electric arc that act in the melting pool when adding a cold non-energized wire. It is possible to increase the welding speed in single bead pass welds or to decrease the number of passes by increasing the volume of the bead.

III. EXPERIMENTAL PROCEDURE

For the tests, it was used a power source, model AristoPower 460 Esab and an OrigoFeed 304N P4 ™ Feeding Head thar was used to feed the non-energized wire.

The bead on plate welding was carried out on a bench designed to provide support and movement of the torch system (energized and non-energized), seeking to move them at controlled and precise speed, as well as fixing the test specimen. The electrical parameters used (current, voltage and welding speed) were determined based on previous experiments and pre-tests with the MAG and MAG-CW welding processes.

The consumables used were the two wires (electrode and cold) and the shielding gas. The AWS 70S-6 electrode consists of a thin wire, with a diameter of 1.6 mm, which is wound on feeder heads and driven to the electrical contact point. (Quites, 2002)[4]. The negative (-) pole of the power source is connected to the test specimen and the other positive pole to the electrode wire, the arc is established between the consumable wire and the base metal. The electrode, therefore, is both electric arc support and addition metal. The arc heat melts the end of the wire and the surface of the base metal to form the welding pool in the welded joint. The non-energized electrode wire is attached and melts in the heat of the arc and the liquid metal is transferred by spray, towards the base metal, forming the welding pool that is fully protected by the active shielding gas composed of a mixture of CO_2 and Ar. In the spray transfer, the arc is quite stable; there is few spatter (Marques, 2012)[5]. The gas is externally fed and flows through a concentric nozzle of the welding torch. (Quites, 2002[4]; Gohr, 2002[6]). The test specimen is an ASTM-A36 plate with dimensions of 19x140x540 mm.

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IV. FIGURES AND TABLES

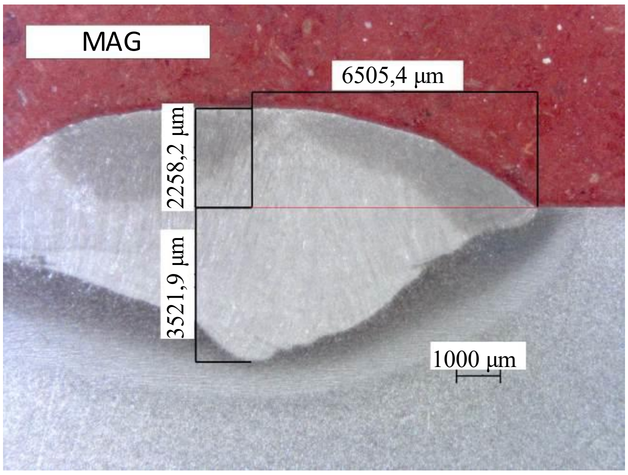

Fig. 1: Weld cord without addition of cold wire in the melt pool

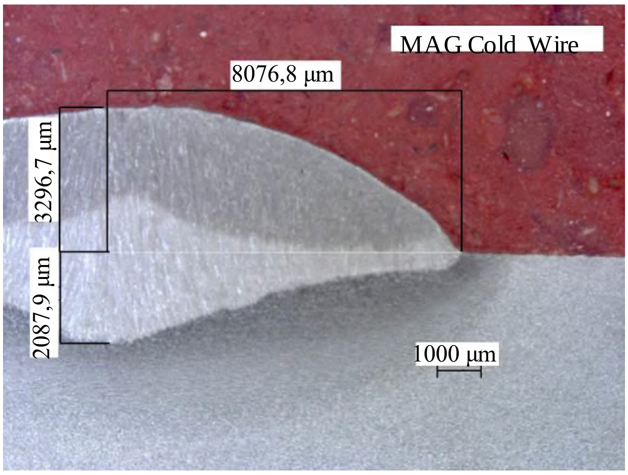

Fig. 2: Weld bead with addition of cold wire in the melting puddle

Tables of results

Dimensions \ Process	*MAG*	*MAG-CW*	*Increase rate (%)*
Width (µm)	*6505,4*	*8076,8*	*24,15*
Height (µm)	*2258,2*	*3296,7*	*45,99*
Penetration (µm)	*3521,9*	*2087,9*	*-40,72*

V. CONCLUSION

The addition of cold wire to the welding pool in MAG process is possible. As a result, it was found a great increase in the deposition rate by weld bead. Its width and height increased, respectively, 24,15% and 45,99%. The MAG-CW process allows to decrease the power consumption, compared to the process with two energized wires. The penetration decreased 40,72%, due the heat needed to melt the cold wire . The penetration profile of the weld can be change decreasing the welding speed. The stability of the electric arc of the MAG-CW is as good as the process with double wire.

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