Theoretical & experimental study of MIG/MAG welding technique

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***Abstract*—** *In this paper I have discussed about the basic mechanism of MIG/MAG welding Techniques which includes MIG/MAG Welding terminologies, factors affecting deposition rate, effects of stick out length, factors affecting penetration, advantages & limitations of MIG/MAG welding technique etc in brief & pictorial forms.*

From this study we can easily understand the mechanism of MIG/MAG welding technique which will be helpful for next research.

***Keywords*—** *MIG/MAG, penetration, shielding gas.*

I. INTRODUCTION

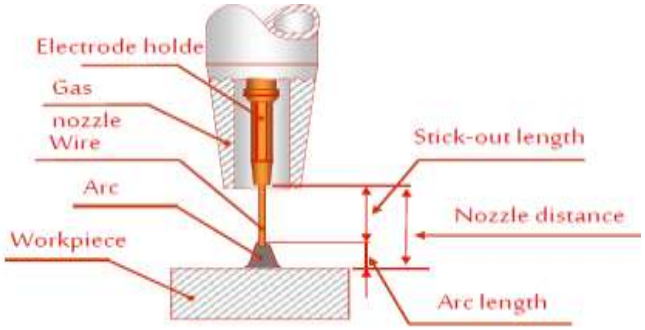
Basically welding process is the joining of two different metals. But being an engineer we have to be more precise, so we can define it as, a special type of welding method which requires the application of certain metallurgic, electric, physical & mechanical properties.

MIG stands for Metal-arc Inert Gas & MAG stands for Metal-arc Active Gas welding technique. MIG/MAG falls under the category of weld techniques as –

Main Group- Arc Welding

Sub Group - Gas Arc Welding.

II. TERMINOLOGY



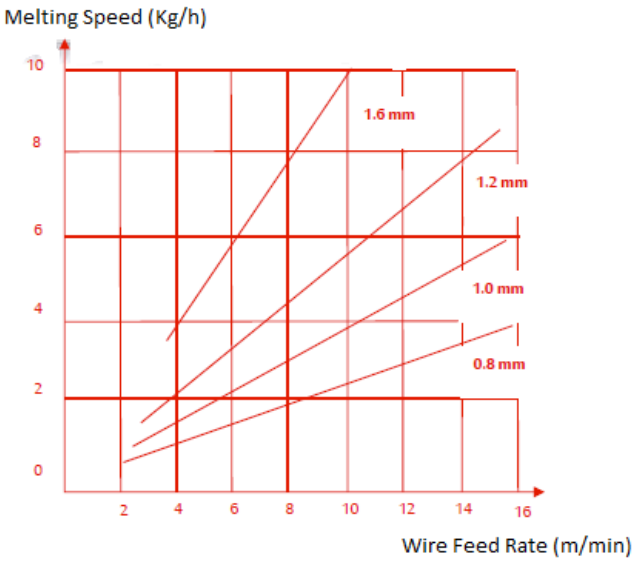
1) Arc Length : Distance between wire & the workpiece
2) Stick Out Length : Length of wire from the nozzle
3) Nozzle Distance : Distance between the nozzle & workpiece.
4) Gas Nozzle : Exit of the shielding gas

III . Factors affecting deposition rate

Deposition rates directly depends on three basic factors viz.- 1) Wire stick out length

2) Wire Diameter

3) Welding parameters

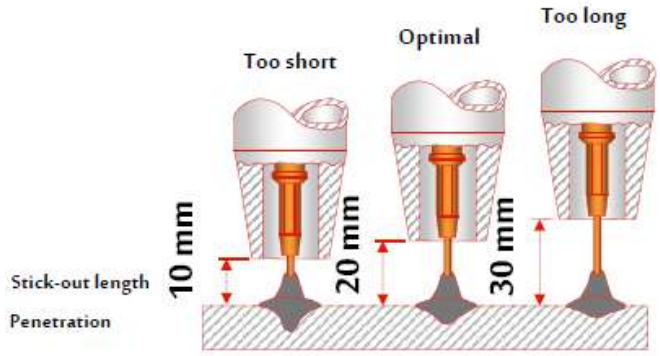


Stic out length (mm)	10	18	25	10	18	25
Wire feed rate (m/min)	9.5	9.5	9.5	8	9.5	11
Welding current (A)	330	300	270	300	300	300
Deposition rate (Kg/h)	5	5	5	4.2	5	5.8

IV . EFFECTS OF STICK OUT LENGTH

Stick out length plays an important role in welding that is illustrated below:

We have studied 3 possible cases of stick out length that can happen with a welder & found the following results:



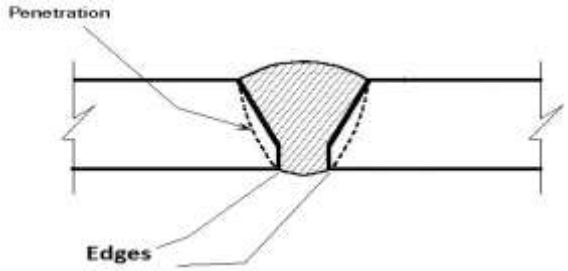
Welding Current	330 A	280 A	240 A
Arc Voltage	29 V	30 V	31 V
Diameter of wire	1.2 mm	1.2 mm	1.2 mm
Wire feed rate	8.8 m/min	8.8 m/min	8.8 m/min

It can be concluded from above example ideal stick out length should be between 15 to 20 mm.

In short we can add tips for stick out length:

1) Short arc welding=10 X Wire Diameter (mm)
2) Spray arc welding=15 X Wire Diameter (mm)

V. FACTORS AFFECTING PENETRATION

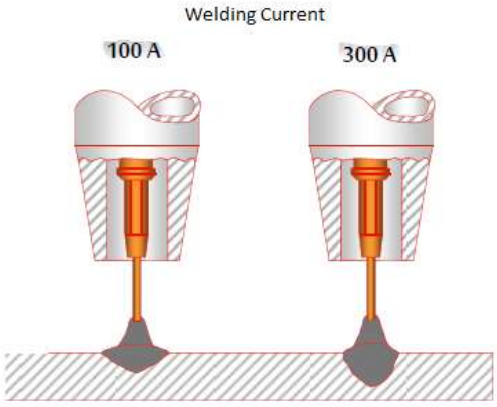


Formation of penetration is very significant phase in welding. It generally occurs when welding torch moves between two joining ends of metal. As the torch heads, the edges of both the sides of metal melts because of high temperatures & submerges in one round plane when we can say penetration has been occurred.

Ideal value / width of penetration is upto 3 mm. There are some factors which affects the size of penetration, that are,

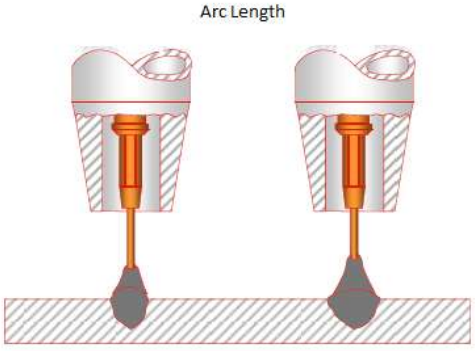
1) Welding Current
2) Arc Length
3) Stick out Length
4) Speed of welding

1)



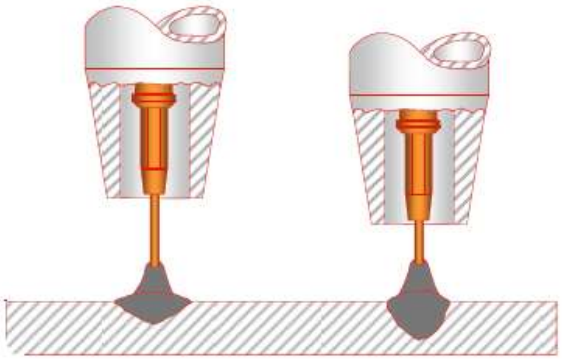
From the figure we can conclude that higher the current more is the penetration & lower the current lower is the penetration.

2)



From the figure we can see that if arc length is less as compared to moderate penetration penetration becomes thin which not the desired situation in welders point of view.

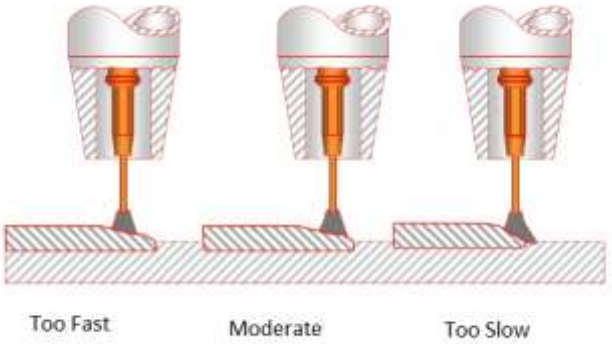
3)



Stick-out length

This case acts exactly same as the arc length case. More the stick out length than moderate wakens the penetration to great extent.

4)



Speed of travel is last but not the least factor that affects penetration.

a) Too Fast- Extremely fast weld run does not allow ends to fuse & submerge as a whole which in turn weakens the weld joint.
b) Moderate- This the allowed speed with which welding gun can travel. This speed gives perfect blend of strength & width of penetration.
c) Too Slow- Excessive slow down occurs excessive penetration which is not cogent situation as per economic issues

VI . ADVANTAGES OF MIG/MAG

1) Continuous wire feeding.
2) Filler material does not form slag.
3) High productivity.
4) Welding in every position.
5) Penetration can be adjusted b changing feed wire rates.
6) Sheet metal welding can be done.
7) Low filler material cost.

VII . ADVANTAGES OF MIG/MAG

1) Sensitive to wind & draught.
2) Limited range & accessibility.
3) Complicated welding equipment
4) Limited mobility.
5) Welding equipment need service.
6) Sensitive for failures.
7) Sensitivity for impurity.

VIII . CONCLUSION

From the all the above discussion we have worked out on basic mechanism of MIG/MAG welding technique. The discussion can be well extended by putting metal or alloy & its behaviour, weldability into the discussion.

IX . REFERENCES

1) A textbook of welding technology, Dhanpaatrai publication, by Mr. O.P.Khanna.
2) Manual ASME Sec. IX
3) Manual Lincoln electric
4) Manual lorch welding machines
5) S.R. Patil, , C. A. Waghmare , (2013). Optimization of MIG Welding parameters for improving strength of welding joints. E-ISSN2249-8974.
6) L. Suresh Kumar, Dr S. M. Verma, P. RadhakrishnaPrasad, P. Kiran kumar, Dr T. Siva Shanker, (2011). Experimental Investigation for Welding Aspects of AISI 304& 316 by Taguchi Technique for Process of TIG & MIG Welding. ISSN:2231-5381
7) NeerajKumar Sharma, Kunal Sharma, (May 2013). To Study The Effect Of Process Variable On Properties Of 2.25cr- 1mo Steel In Gmaw. E-ISSN: 2278 0181.