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Effect of Adding both Preheating and Tempering Current on Tensile Strength of Resistance Spot Welding of IS2062A Mild Steel Sheet

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Abstract— Resistance spot welding is widely used in industries due to its low cost and less time consuming nature. The strength of welded joints plays an important role in industry. The effect of adding preheating and tempering current on the resistance spot welding is analysed by conducting experiment in IS2062A mild steel. IS2062A is widely used steel for structural purposes.so the study covers a wide range of industries. From the study it shows tensile strength can be increased by adding both preheating ad tempering current.

Keywords— Resistance Spot Welding, Preheating, Tempering , IS2062A Steel Grade

I. INTRODUCTION

Resistance Spot Welding is very famous and effective welding process using in industries. It is commonly used in aerospace and automobile applications. Resistance spot welding has a desirable characteristics of energy efficiency, narrow heat affected zone and simplicity. This makes it popular in manufacturing process. Nowadays its demand has increased in biomedical field also. It is very much suitable for joining thin sheet of material.

The heat released by metal due to its property of resistance to electric current makes the metals join together. This is the principle of working of resistance spot welding. It works on the principle of frictional resistance offered by sheets to welding current creating a molten pool and the application of squeezing pressure and it compress the molten pool into solid weld at spot. High resistance flow of welding current offered by faying surface, which is a surface creates a contact between two plates. The electrodes which are used for welding are made of copper, because of their low resistance, which allow them to conduct electricity more efficiently.

In this research paper we are dealing with the effect of both preheating and tempering on the tensile strength of resistance spot welding of IS:2062A steel. IS2062A is very commonly used in mild steel for structural purposes. They are low carbon steel and they offer good formability, weldability , and machinability. These are mainly used in automobile, fabrication, infrastructure, general engineering and machine building purpose.

II. EXPERIMENTAL STUDIES

In this experiment steel grade of IS2062A steel sheet is welded using 50KVA resistance spot welding machine. The experiment was conducted in National Institute Of Technology Tiruchirappalli. The parameters consider for the study includes holding time, squeeze time, electrode tip diameter, electrode force and change in welding current and heating time. The welding parameters for this steel grade is found out using design of experiment techniques.

The chemical composition and mechanical properties of experimental steel are shown in table 2.1 and 2. 2 respectively.

C% max	Mn% max	S% max	P% max	Si% max	C.E.% max
0.23	1.50	0.050	0.050	0.40	0.42

Table 2.1 Chemical composition in mass%

Thickness (mm)	Yield strength(MPa)	Tensile strength(MPa)	EI.%
1.6	230	410	23

Table 2.2 Mechanical properties of experimental steel

Microprocessor controlled 50 KVA DC pedestal type resistance spot welding machine operating at 50Hz as shown in figure 2.1. Welding trials are conducted using a 81^0 truncated cone nose, class 2 electrode tip diameter of 7mm width and 3.2KN electrode force and 15 cycles squeeze and holding time facilitates welding 1.6mm thick IS 2062A steel sheets.

Fig 2.1 Resistance spot welding machine

The welding is performed in the steel using the welding parameter obtained from design of experiments. Four samples are prepared by taking dimension as shown in figure 2.2 for conducting tensile test. The welding parameters for these welding samples are shown in table 2.3. The tensile tests are performed using a Tinius Olsen universal testing machine with crosshead movement of 1mm/min. The force displacement curve was recorded simultaneously and force displacement curve is plotted.

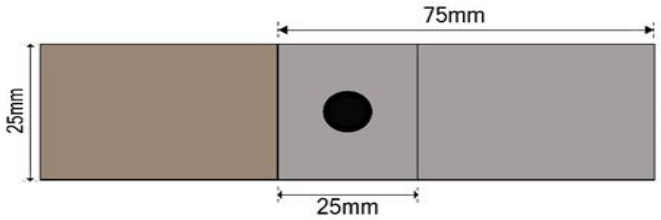

Fig 2.2. Dimension of welding sample

Sample No:	Electrode tip force (kN)	Preheating current (kA)	Preheating time (Cycles)	Welding current (kA)	Welding time (Cycles)	Tempering current (kA)	Tempering time (Cycles)	Holding time (Cycles)
1	3.2	Nil	Nil	9	12	Nil	Nil	15
2	3.2	3	12	9	12	Nil	Nil	15
3	3.2	Nil	Nil	9	12	4	12	15
4	3.2	3	12	9	12	4	12	15

Table 2.3 welding process parameter

III.RESULT AND DISCUSSION

There are four groups of comparative experiments in this study. The welded samples are shown in fig 3.1. Sample 1 has only one pulse current of 13 kA. Sample 2 has an extra pulse current of 5 kA for preheating, sample 3 has an extra pule current of 6 kA for tempering and sample 4 has an extra pulse current of 5 kA for preheating and 6 kA for tempering compared with sample1.Shear tensile test conducting on Tinius Olsen machine is shown in fig 3.2. The shear tensile strength of these samples are compared.

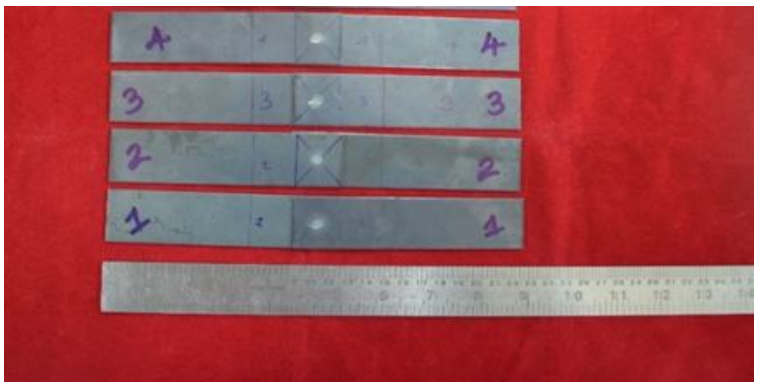

Fig3.1 welded samples

Fig 3.2 Tensile test conducting on Tinius Olsen machine

A. Mechanical Properties

The load displacement graph for welded samples is shown in fig.3.3

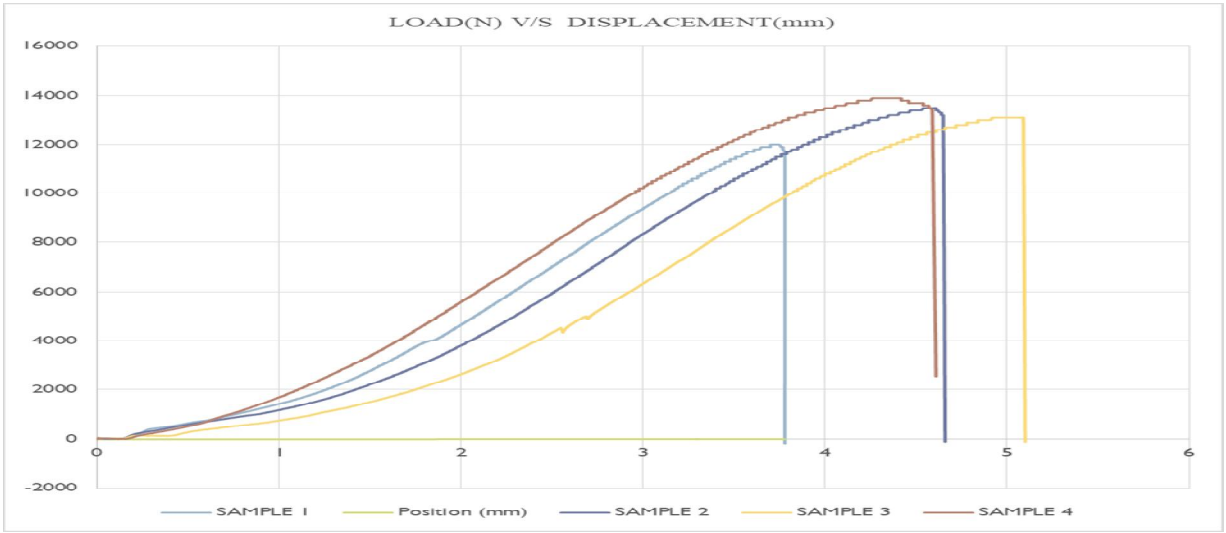

Fig 3.3 load displacement graph

From the graph we can see that the shear tensile strength of welded sample increases on adding preheating, tempering, both preheating and tempering current. Sample 1 has maximum shear tensile strength of 12 kN, while the maximum shear tensile strength of sample 2, sample3 and sample 4 are 13.5 kN, 13.1 kN and 13.9 kN respectively. This result shows that the sample 4 has maximum increase in shear ensile strength. That is by adding both preheating an tempering current to the resistant spot welded sample can increase the shear tensile strength.

IV. CONCLUSION

The tensile strength of the resistance spot welding can be increased by adding preheating and tempering current. But the addition of both preheating and tempering current to the same sample can increase its shear tensile strength more.

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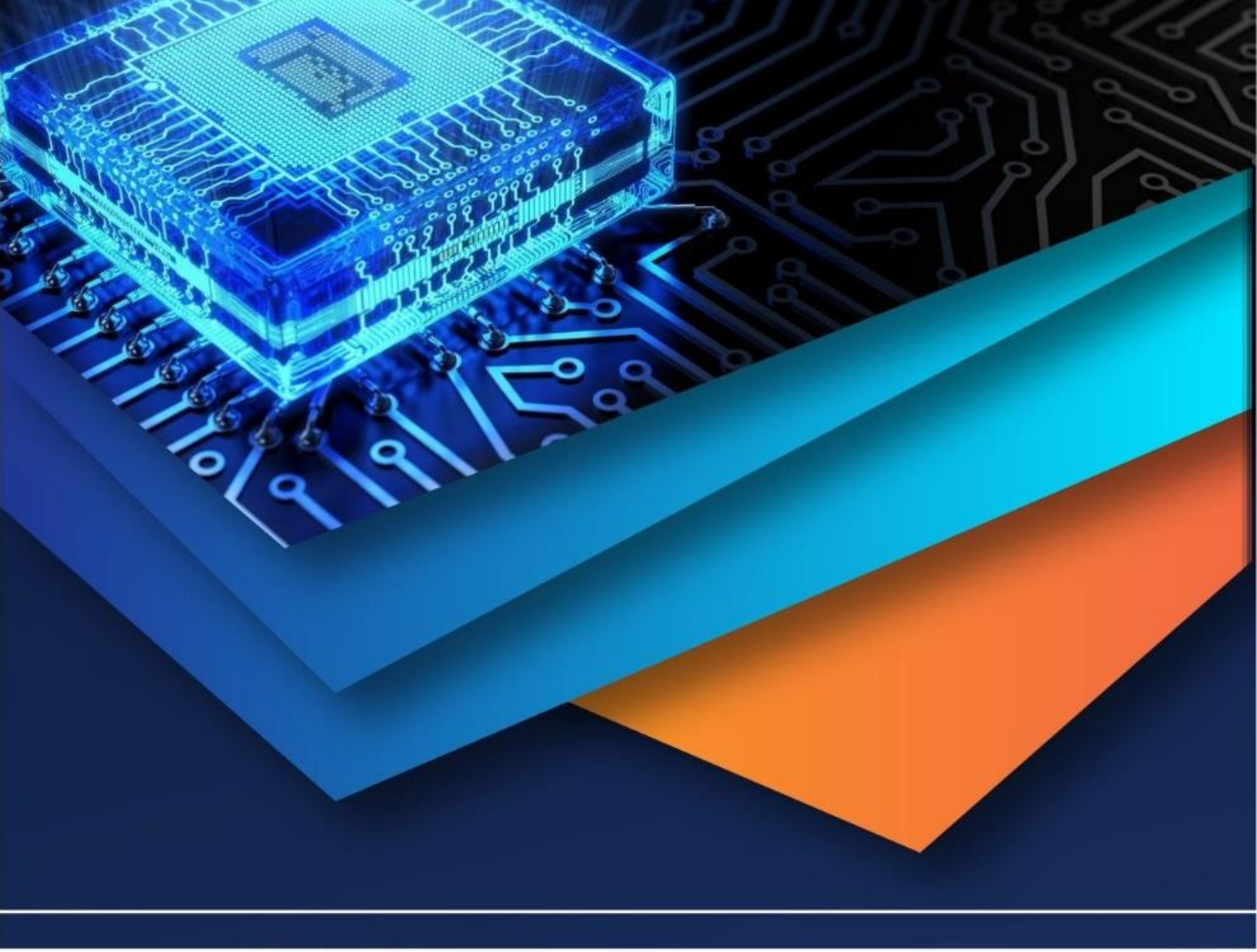

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