STUDY OF SPOT WELDING OF AUSTENITIC STAINLESS STEEL TYPE 304

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Abstract
In this study, austenitic stainless steel type 304 were welded by resistance spot welding. The relationship of nugget diameter and welding current was investigated. Hardness distribution along welding zone was also investigated. The results indicated that increasing welding current gave large nugget diameter. The welding current did not much affected the hardness distribution.

Introduction

Resistance spot welding is usually used in the fabrication of sheet metal assembly. It can be used to weld materials such as low carbon steel, nickel, aluminum, titanium, copper alloy, stainless steel and high-strength low alloy steel. Resistance Spot welding process is most applicable in the industrial fields of manufacture and maintenance (car industry, aerospace and nuclear sectors, electronic and electric industries). Murat et al. [1] have studied on the resistance spot weldability of galvanized interstitial free steel sheets with austenitic stainless steel sheets. In microhardness measurements, the maximum hardness values were in the middle of the weld nugget. Emin Bayraktar et al. [2] have contributed their research on the selection of optimal welding conditions and developed new grade steels for automotive applications. The study based on impact tensile testing to spot welded sheets. The effect of nucleus size on mechanical properties in electrical resistance spot welding of chromide micro alloyed steel sheets was investigated by Aslanlar [3]. Bouyousfi et al. [4] have studied the effect of process parameters (arc intensity, welding duration and applied load) on the mechanical characteristics of the weld joint of austenitic stainless steel 304L. The results showed that the applied load seems to be the control factor of the mechanical characteristics of weld joint compared to the welding duration and the current intensity. Nizamettin K [5] has focused his study on the influence of welding parameters on the joint strength of resistance spot-welded titanium sheets. The results indicated that increasing current time and electrode force increased the tensile shear strength and the joint obtained under the argon atmosphere gave better strength. Hardness measurement results showed that welding nugget gave the highest hardness. The argon gas used during the welding process was seen to have no influence on the hardness values. This paper presents the effect of welding current on the physical properties of austenitic stainless steel type 304.

Experimental

The materials studied are austenitic stainless steel type 304. The specimens were placed on each other and the welding current was changed from 2.50, 3.75, 5.00 and 6.25 kA during welding process. The nugget diameter was measured for each welded specimens. The microhardness measurements were performed o the weld metals, HAZ and the base metal.

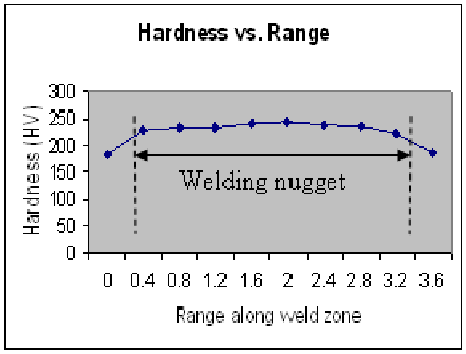
Results and Discussion

The diameter of each nugget were measured and shown in Table 1. From this table, it was proven that the weld nugget increases with the increasing welding current. Weld nugget for sample 4 with welding current of 6.25kA has the widest diameter of all samples.

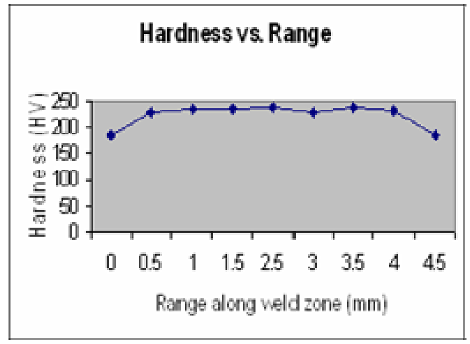
Table 1: Nugget diameters produced by each applied welding current.

Samples	Welding Current (kA)	Nugget Diameter (mm)
Sample 1	2.50	3
Sample 2	3.75	3
Sample 3	5.00	5
Sample 4	6.25	6

Microhardness measurement was carried out on the cross-section samples across the horizontal of the nuggets. Figures 1(a) to 1(d) show the effect of hardness distribution along the weld nuggets due to the varied welding current. Generally, from the figures, it can be seen that weld nugget has higher values of hardness compared to the heat affected zone and base metal. The hardness distribution across molten metal or weld nugget for all sample were almost the same. This shows that by varying the welding current, the hardness distribution across the weld nugget was not much affected. In the study carried out by Murat et al. [6], the hardness distributions were measured starting from the centre of the weld, while in this study the measuring was started from left to the right part. Compared to the hardness values that were obtained by Murat [1], the hardness across nugget diameter of the samples were much smaller. This is because of the large differences in the parameters used such as the electrode force and sample thickness. The hardness of the weld nugget depends on the amount of deformation during the holding time and resting time of welding process.



(a)



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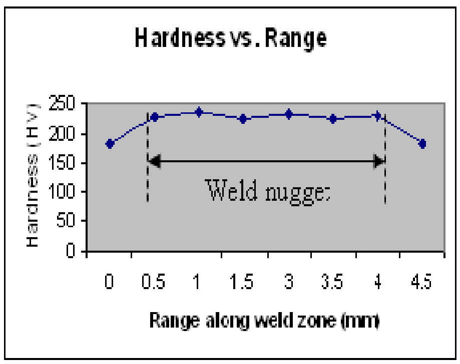

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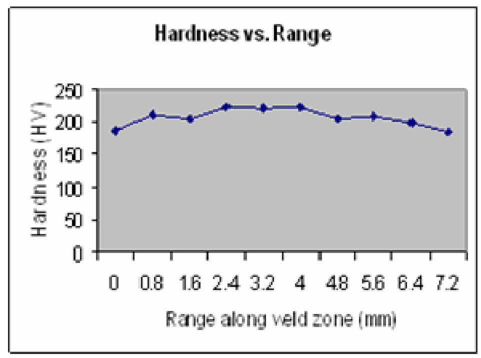

(d)

Figure 1(a-d) The microhardness distribution in the welded zone according to the increasing of welding respectively.

Conclusion

i) Increasing welding current increased the nugget size.
ii) The nugget size does not influence the hardness distribution.
iii) Increasing welding current does not increase the hardness distribution.

References

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