J. SELEJDAK

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INFLUENCING FACTORS ONTO QUALITY OF WELDED PIPES

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At days of market economies and large competitiveness in the world, the most important assignment for enterprises is maintenance of their customers. If an enterprise wants to execute this it has to take care about the very best quality of its articles and has to improve it constantly. It was decided to deal with quality problems in this paper which appear during compound technological production process of welded tubes. This process is a process of great frequency welding. The quality of welded tubes is largely influenced by batch material. Steel tapes should not contain unmetalic interpolations. Fragile unmetalic inclusions make difficult process of pipe welding as well as welds or area next to weld. These inclusions have unfavorably influence onto quality. In the paper different problems were described which appear during technological process of pipes welding such as bad cutting of the tape/batch, cold welds or else convexity of bands. It has also introduced proposal of prevention activities in future.

Key words: *rolling process, welding process, control, quality product*

Čimbenici koji utječu na kvalitetu šavnih cijevi. U vrijeme tržišne ekonomije i velike konkurencije u cijelom svijetu najvažniji zadatak svim poduzećima je zadržati svoje kupce. Ako neko poduzeće želi to i učiniti, mora se pobrinuti za najbolju moguću kvalitetu svojih proizvoda i nastaviti raditi na njenom usavršavanju. Zato je odlučeno da se u ovom članku obrade problemi koji se javljaju tijekom složenih tehnoloških procesa izrade šavnih cijevi. To je proces zavarivanja strujom visoke frekvencije. Kvaliteta šavnih cijevi jako ovisi o kvaliteti uložnog materijala. Čelične trake ne bi smjele sadržavati nemetalne uključke. Lomljivi nemetalni uključci otežavaju proces zavarivanja cijevi i imaju nepovoljan utjecaj na kvalitetu. U radu su opisani različiti problemi koji se pojavljuju tijekom tehnološkog procesa zavarivanja cijevi kao npr. loše rezanje trake, uložak, hladni zavari ili konveksnost trake. Također je iznijet prijedlog za provođenje zaštitnih radnji u budućnosti.

Ključne riječi: *proces valjanja, proces zavarivanja, kontrola, kvalitetna proizvoda*

INTRODUCTION

The ever increasing competition on the market forces companies to keep on improving the quality of the products they manufacture [1]. Because the impetuo-us development of many branches of industry causes the in-crease of requirements of users of metallurgic articles. These requirements refer to improvements of the mechanical and technological properties and enlargement of exactitude of dimensions, especially thickness, and essential improve-ment of quality of the sheet metals and tapes surface [2-3].

Welded pipes find application in many areas of economy, among other things, also for the production of chemical facilities, power industry, as heat transferring pipes, but above all as pipes for the transport of power media, mainly gas and oil. Welded pipes that serve the purpose of gas or oil transport are manufactured of non-alloy or low-alloy steels, either as welded or as heat-bonded ones [4].

The input material for the production process is a steel tape. The tape from the spiral battery is directed by means of an appropriate set of leading rolls into the system of forming rollers, where it is wrapped into a slot tube and then introduced into a heating set, where a current coming from a high frequency generator flows through the slot tube's edges making them heated by an appropriate clamp of tube welding rollers [5].

INDUCTION HEAT-BONDING OF TUBES USING HIGH FREQUENCIES

During a high frequency welding process, high frequency current at the level of about 400 kHz is induced in an open tube by means of a coil fixed on the outside of the

J. Selejdak, Faculty of Materials Processing Technologies and Applied Physics, Technical University of Częstochowa, Częstochowa, Poland

welding point (Figure 1.). Tube edges come closer to each other coming through the coil into the so called “angle”, whose tip is located slightly in front of the welding point. The coil does not come in contact with the tube.

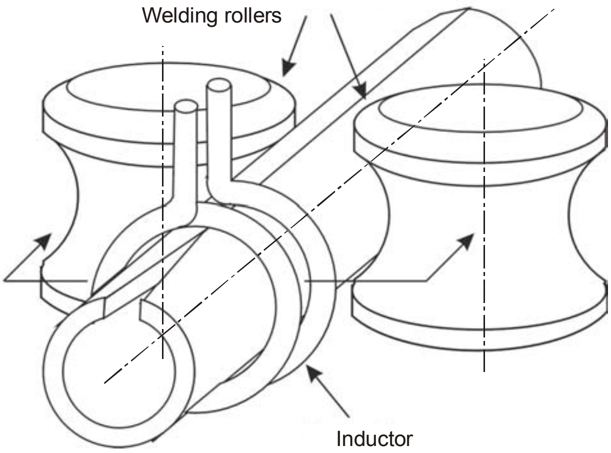

Figure 1. **Induction welding process**
Slika 1. **Postupak zavarivanja indukcijom**

QUALITY MANAGEMENT DURING THE PROCESS OF HEAT-BONDED TUBES PRODUCTION

Bad quality of the input material may cause some problems during both the pipe heat-bonding process and in the earlier processing of the material. As a result of an inappropriate chemical constitution of the steel tape used in welded pipes production we obtain a product that is non-formant with the relative requirements. With the wrong chemical constitution, steel tapes may also contain non-metallic inclusions (for instance sulfide inclusions), which act as internal curbs that lower plasticity properties of the material.

As a result of the welding process, there occurs on the tube a swelled scale (so called internal and external inflow). The external inflow is removed by a machine knife. In some special cases, the internal inflow is removed too. After cooling down by means of an emulsion, the tube undergoes the calibration process in the set of calibration rollers, where it achieves a proper shape and final dimensions of its outer diameter. Then the tube is straightened and given maximally precise dimensions. The finished tube is cut into sections using a flying saw, the lengths of them are as specified in the order [5].

In order to control heat-bond quality and eliminate defective pipes, they are controlled in line with the heat-bonding machine by an analyzing instrument installed before the saw blade [5]. The electronic memory system segregates the pipes into [5]:
- good pipes, directed to the left side of a discharge mechanism,
- bad pipes, directed to the right side of a discharge mechanism.

Tape convexity may cause various problems. Tapes can at times be wound inside the bending machine, or they may slide between rollers. Protrusions may occur on one side or on two sides.

A very important role in the heat-bonding process is also played by tape edges: wrongly cut tapes can even result in defects of the bending machine. Highly rusted edges may affect heat-bond quality through lowering the viscosity of the melted material.

Due to various loads of the bonding machine electrical system, there may appear differences in the voltage. If such differences are high and additionally sudden, they may result in momentary reductions in the bonding current, which leads, in consequence, to the occurrence of cold areas in the heat-bond zone.

Hot-rolled tapes will always have some scale upon its surface. The scale will gradually break and come loose during the profiling process. Scale remains are transferred by the cooling lubricant onto other elements, up to the last boxes. If the contaminants get through to the angle during the heat-bonding process, they begin to act as a large lump of bonding oxides. These can transmit enough energy for the occurrence of an electric arc. If such an arc takes place, there will always emerge so called point cold bond. In the other case, contaminants will get through to the top, where they will produce too large an amalgamation of contaminants, and, due to this, the difficulty in pressing down the edges. It is advisable to rinse from time to time the places where the scale amalgamates. The application of fine gas in the high-frequency heat-bonding process may limit the occurrence of oxides [6].

If during the heat-bonding process bonding rollers are not placed centrally, or when the tape is wrongly cut, this may result in a defective pipe seam.

The most important elements of the pipe quality management process are [7]:
- the control of tape edges preparation is very significant, as it exerts an impact of scale occurrence,
- the control of heat-bonding conditions (heat-bonding line energy, the amount of swelling, decide about the quality of the bond.

CONCLUSION

The quality of welded (hot-bonded) pipes is affected by:

- the quality of the input material,
- the chemical constitution of the steel tape used for the production of welded pipes should meet the requirements of the relevant standards,
- steel tapes should be free from any non-metallic inclusions. Crisp non-metallic inclusions make the pipe heat-

bonding process difficult, and exert a negative influence upon the bond itself and its neighboring area,

- tapes used for the production of welded pipes should have no protrusions or waves at the edge, the edges should be straight and free of any contaminants.

In order to eliminate problems arising at the production of heat-bonded pipes state-of the-art pipe-bonding are used which improve the quality of the final product which is the pipe. New systems high setting accuracies allow to achieve a better outcome, and at the same time they demand much lower costs than seam-less pipe rolling facilities.

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