

THE APPLICATION OF ULTRASONIC TESTING FOR COATING LAYER BONDING OF COPPER MOLD

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INTRODUCTION

Because the nickel alloy layer of copper mold of continuous casting machine in steel mill, the adjoining surfaces of mold in pouring gate due to the high temperature and the molten steel attrition creates the breakage or the peeling. Therefore use ultrasonic testing to pick out the bad adjoining surfaces of mold in time to avoid the nickel layer's breakage. In the casting process, the breakage of mold cause the cooling water contact with the molten steel creates BO. Thus cause not only the production loses but also creates the gas to explode and cause the personnel and the equipment dangerous loss.

COPPER MOLD DAMAGE INVESTIGATION



Figure 1. Top view of Mold of casting machine in pouring gate



Figure 2. Short distance top view of Mold of casting machine in pouring gate

BREAKDOWN INSPECTION



Figure 3. Close view of outward appearance of damage mold in pouring gate



Figure 4. The nickel layer split off from the copper mold

ULTRASONIC TESTING

In view of UT testing of replacement mold for bonding layer of nickel. Discovery the surface of mold has fissure, in fact layer and the parent metal has had the big area peeling, as shown in Figure 5.~6.



Figure 5. Left is the surface fissure of copper mold and right figure is close shown



Figure 6. Left is Split off area of nickel layer of copper mold and right figure is close shown

TESTING METHOD AND EQUIPMENT OF UT

By using calibrated UT equipment with A-scope. Double crystal straight beam transducer, such as: KK MSEB4(4MHz 10mm). UT setting

Range Full range 50mm

Sensitivity Set the transducer on good condition area and adjust B1 80

Scanning gain : B1 80 6dB

When bonding layer not good appear the multiple echo signal, the bonding layer good, only appears the bottom surface echo signal as shown in Figure 7.~ 8.

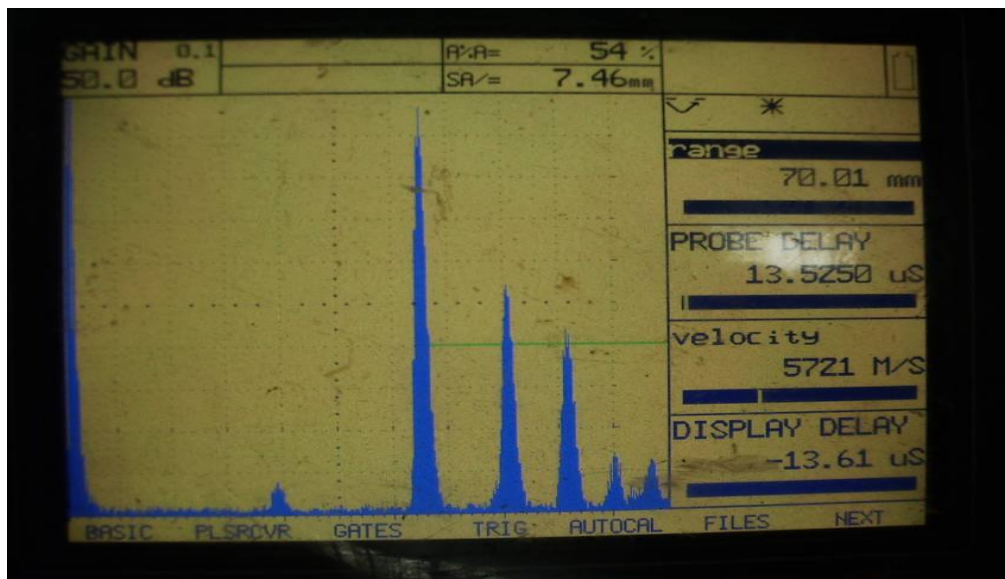


Figure 7. The bonding layer good appears the bottom surface echo signal

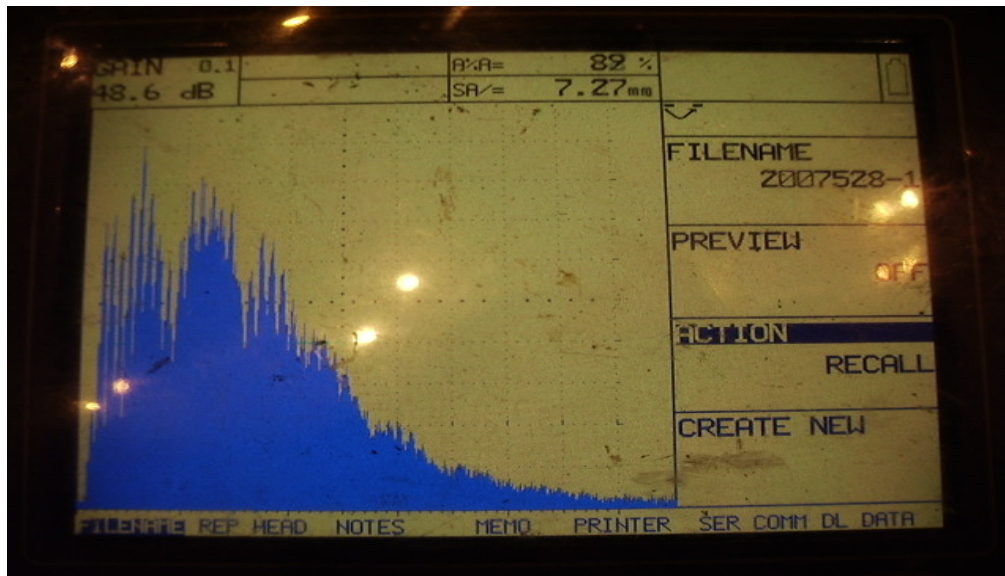


Figure 8. When bonding layer not good appear the multiple echo signal

MAIN RESULTS

1. The UT testing may go a step further to quantification examination of the layer bonding percentage, confirmed the acceptance level of galvanization process of nickel layer of copper mold.
2. Copper mold for conticaster, after the coating nickel layer by galvanization processing and the machine-finishing complete must pass through the UT testing for confirmation quality of bonding condition.

DISCUSSION OF RESULTS

1. Coating nickel layer of copper mold must serious control in the production system, otherwise easy to have the bonding problem.
2. The copper mold in different continues casting machine under the same condition of casting process, coating layer has the different result actually, therefore may suspect reasonably the casting machine has the sensitive factor cause fissure and dis-bonding of layer during the maintenance process, suitable further comparative analysis. To avoid the trend opportunity of fissure and dis-bonding of nickel layer of the copper mold by continually collect records, reorganizes the events condition, and seeks the process condition, the maintenance condition optimization.

CONCLUSION

To using UT testing for checking layer bonding condition of mold is important for prevent or reduce the fissure and dis-bonding probability in conti-casting production line.