

(409) EVALUATION OF INCLUSION CLEANLINESS BY ULTRASONIC FOCUSED PROBE TESTING

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1) Introduction

Ultrasonic technic of focused probe immersion testing has been developed, in recent years, to detect submillimeter inhomogeneities. Now, IRSID is using this technic in inclusion cleanness assessment of steel products.

2) Principles

IRSID particularities are a complete and very fast digitalisation of ultrasonic signals received when a probe is scanning along two perpendicular axis, over a steel sample. After data logging, a digital treatment of datas gives cartographies, histograms or ratings which yield qualitative (geographic positions), and quantitative (echoe density) informations of detected reflectors distributions.

3) Data logging of ultrasonic signals (Fig.1 and Fig.2)

During ultrasonic testing, the control center is a micro-computer which drives all the data logging devices. Thus, when the probe stops, computer controls both ultrasonic generation and probe displacement a stop further. Ultrasonic echoes are transmitted, to an Analog-Digital Converter.

This converter is able to take a selection of ultrasonic events, beginning just after interface echoe and ending before bottom echoe. This selection is sampled at 20 MHz and for each time sample, intensity is digitalised on 8 bits. The transfered data from A/D Converter to computer memory through Direct Access Memory device allows a rate up to 6×10^5 bytes per second. Into computer central memory, data are reduced without significant losses of information.

4) Results and Conclusions

Fig.3 presents data treatment results : for a low carbon steel sample of ingot billet. In same way, a large number of ultrasonic testing records has been achieved, and has lead to these conclusions :

- Ultrasonic sensitivity is sufficient to detect and record informations about inclusion populations of different natures (aluminates, manganese-sulfides, silicates) with lowest critical size near $100 \mu\text{m}$ diameter.

- Quantitative informations can be bring out only for cases in which the most part of parameters of ultrasonic detection cancels, due to stability in steel samples series and conditions of operation.

- The ultrasonic method and destructive other methods of investigation like microscopy inspection are complementary, however good agreements among all these methods are impossible because inclusion population parts detected by each are disjointed.

In conclusion, IRSID investigations on the subject have determined possibilities of ultrasonic testing in inclusion evaluation. Which technic could take important place in several industrial configurations of quality control of steel products.

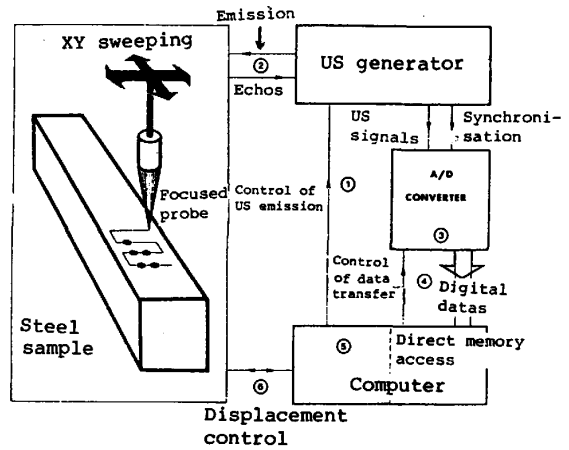


Fig. 1 Principles of data logging

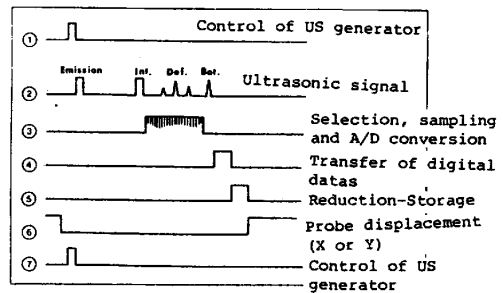


Fig.2 Timing of a data logging cycle.

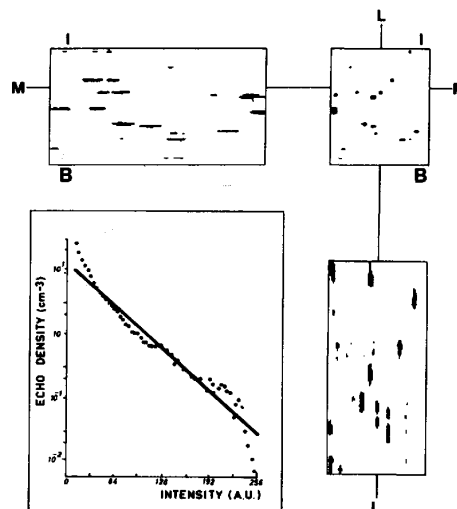


Fig. 3 Cartographies and histograms of echos obtained in U.S. testing of a low carbon steel sample.