Optimisation Frequency Design of Eddy Current Testing

Fauziah, S.*, Elya, A.

[1,2] *Faculty of Science and Natural Resources, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia.*

*Correspondence Email : fauziahs@ums.edu.my
elya_92@yahoo.com.my

ABSTRACT

The main objective of this paper is to present a study on non-destructive testing (NDT) technique. The technique testing is Eddy Current Technique (ECT) where copper (Cu) and Magnesium Alloy (Mg Alloy) metals in 100mm X 100mm X 1.5mm dimension were chosen as the metal testing. Identical artificial defect then constructed on the metal testing and were tested to find its optimal frequency. The input frequencies were ranged between 10-120 kHz and a dual sensors were designed and established to gather the output. The output signals of the voltage of testing from the sensor circuit then compared to analyse the optimal of range frequency for the testing instrument. The result of this research showed that the nondestructive metal testing instrument of dual sensor by using eddy current method can be used to find different defect for copper (Cu) and Magnesium Alloy (Mg Alloy). The optimal frequencies for copper and magnesium alloy metal is 60 kHz.

Keywords: Non-destructive testing (NDT), eddy current technique, optimal frequency.

INTRODUCTION

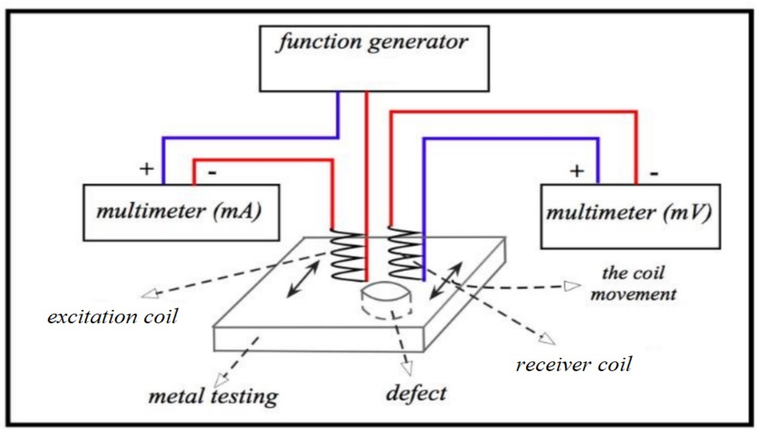

Fig.1: The block diagram of the experiment.

Eddy current technique is an important electromagnetic non-destructive evaluation technique that is widely used in many industries for detection of surface cracks and sub-surface damage in components made of metallic materials. There are some advantages on using eddy currents for NDT purposes. It quick, simple, and reliable inspection technique to detect surface and near-surface defects also can be used to perform several tasks like thickness measurements, corrosion valuation electrical and magnetic permeability measurements. There is no need for consumables and the inspection surface preparation is minimal and results are drawn immediately [Zhou, 2015].

METHODOLOGY

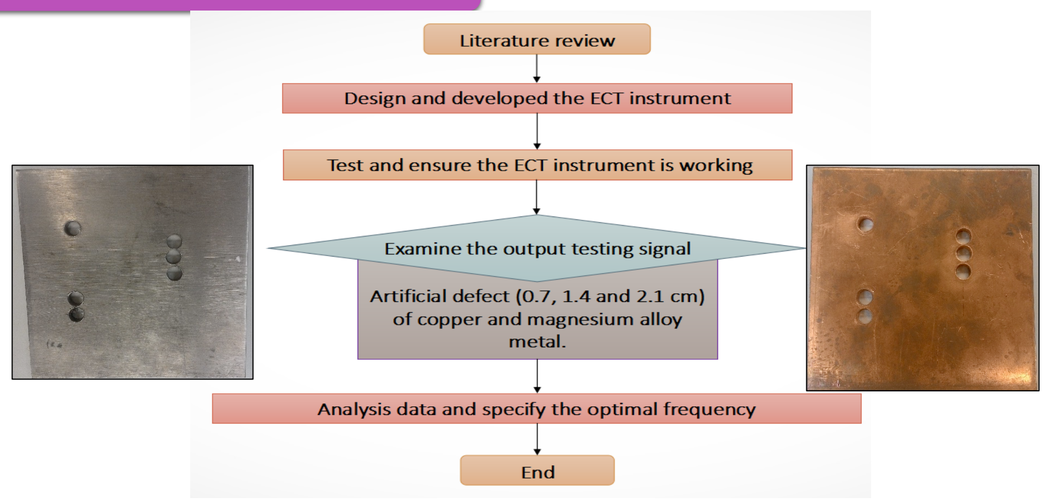

Fig.2: Flowchart of experiment

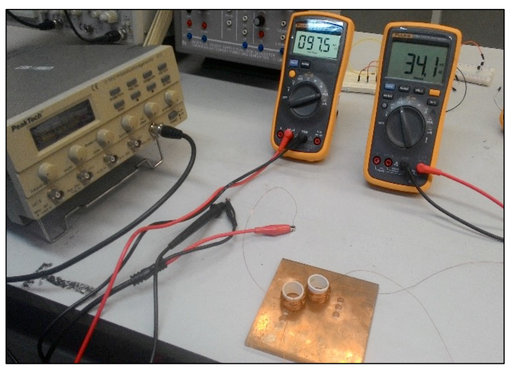

Fig.3: Experimental set-up

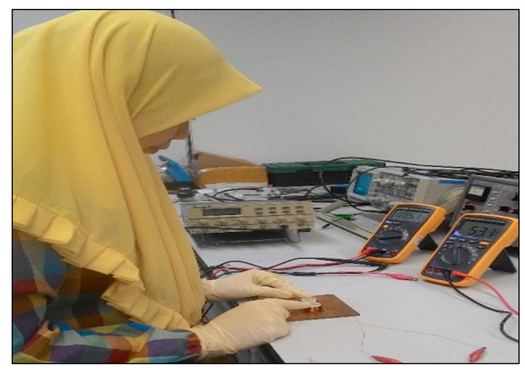

Fig.4: Experiment activity

RESULTS AND DISCUSSION

The result for this experiment in metal testing instrument for imperfection metal by using eddy current method. Sample of copper and magnesium alloy had been drilled with different of width on the surface. The frequency used was between 20 – 110 kHz and then the output signals were plotted in a graph to compare the differences of imperfection.

The output testing signal imperfection by using copper metals

The peak shows that 60kHz is the optimum frequency because of the limitation of the output voltage became maxmimum.

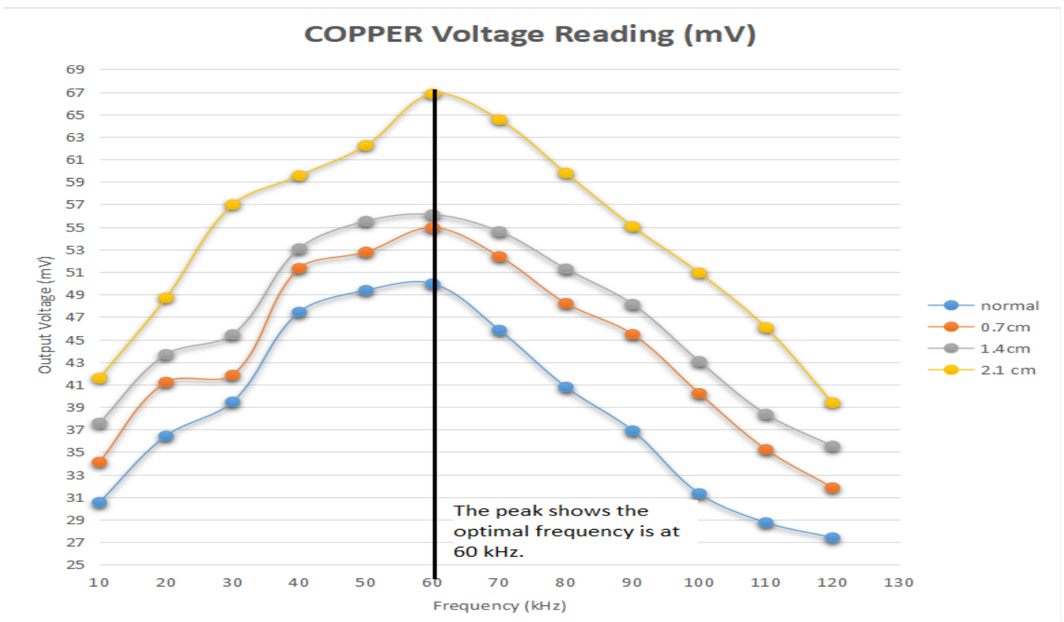

Fig.5: The graph of output voltage against frequency.

The output testing signal imperfection by using magnesium alloy metal

The peak shows that 60kHz is the optimum frequency because of the limitation of the output voltage became maxmimum. Eventhough on defect 2.1 cm it shows at 70kHz but all the most obvious peak shows at 60kHz.

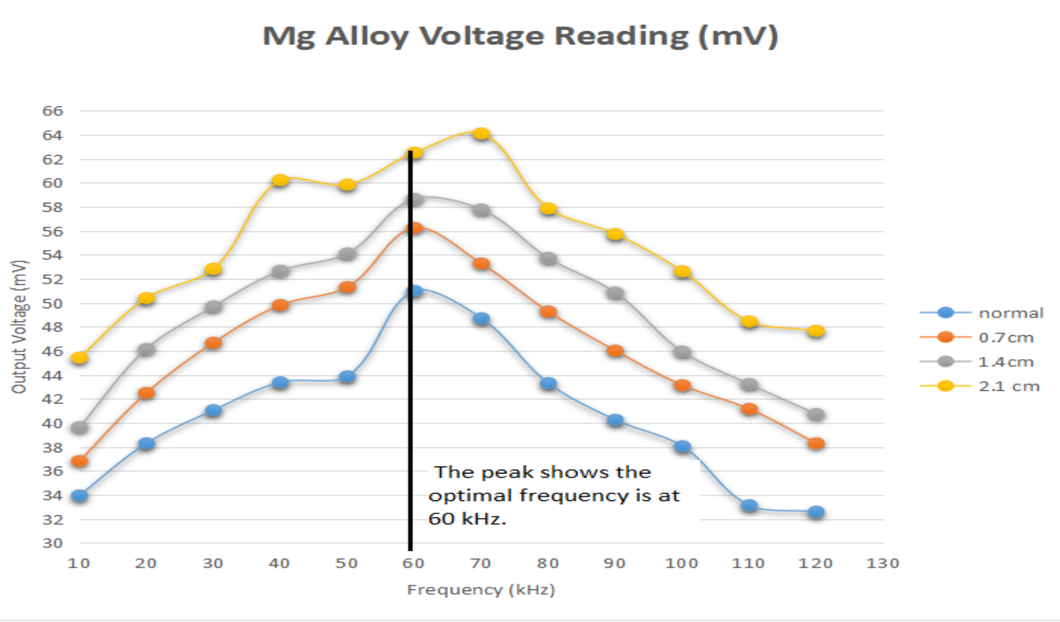

Fig.6: The graph of output voltage against frequency.

REFERENCES

Aarti H. Tirmare, Ms.Sangita R .Mohite, Ms.Priyadarshni S. Mali, Mrs Varsha.A.Suryavanshi. FPGA Based Function Generator, 2015.

Daniel Pereira and Thomas G. R. Clarke. Modeling and Design Optimization of an Eddy Current Sensor for Superficial and Subsuperficial Crack Detection in Inconel Claddings, 2015.

Giovanni Betta, Luigi Ferrigno, Marco Laracca, Pietro Burrascano, Marco Ricci and Giuseppe Silipigni. An experimental comparison of multi-frequency and chirp excitations for eddy current testing on thin defects, 2014.

H.T. Zhou, K. Hou, H.L. Pan, J.J. Chen, and Q.M. Wang. Study on the Optimization of Eddy Current Testing Coil and the Defect Detection Sensitivity, 2015.

Javier García-Martín, Jaime Gómez-Gil and Ernesto Vázquez-Sánchez. review paper Non-Destructive Techniques Based on Eddy Current Testing,2011.

L.Dziczkowski. Effect of Eddy Current Frequency on Measuring Properties of Devices used in Non-Destructive Measurement of Non-Ferromagnetic Metal Plates, 2008.

Mengbao Fan, QiWang, Binghua Cao, Bo Ye, Ali Imam Sunny and Guiyun Tian. Frequency Optimization for Enhancement of Surface Defect Classification Using the Eddy Current Technique, 2016.

CONCLUSION

As a conclusion, this research will develop and establish an optimal frequency for the types of metal testing instrument in strengthen the test of imperfection on metals. It is hope that it will contribute to an improvement of eddy current technique (ECT) of metal testing and can be used in industrial inspection to avoid accidents and any misfortune.

ACKNOWLEDGEMENT

The authors would like to thank Universiti Malaysia Sabah for supporting the present study through the grant of UMSGreat:GUG0018-SG-M-1/2016 and SBK 0280-SG-2016.