MEASUREMENT OF POWER LOSS IN TRANSFORMER CORES BUILT WITH AMORPHOUS MATERIALS

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M.Sc 1986

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by

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A dissertation submitted to the University of Wales for the partial candidature of Master of Science degree

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September, 1986.

DECLARATION

I declare that the work submitted for this degree is the result of my investigation and has not been submitted in candidature for any other degree.

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Candidate

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TO MY FAMILY

ACKNOWLEDGEMENTS

The work was carried out at Wolfson Centre for Magnetics Technology, Department of Electrical and Electronic Engineering, University College, Cardiff and thanks are due to Professor J.E. Thompson for readily allowing me to use the facilities of the Department of Electrical and Electronic Engineering.

I wish to express my profound gratitude to my supervisor, Dr. A. Basak, for his guidance, assistance and encouragement during the period of my research; and Dr. T. Meydan, the technicians and other members of staff at the Wolfson Centre for Magnetics Technology for their help.

Thanks are also due to the Algerian Government for providing me with a grant throughout this Course.

Finally, my thanks go to Mrs. Barbara Richards for her excellent work in typing the thesis.

SUMMARY

Various single phase transformer cores were built in a 15cm Epstein frame for power loss evaluation. Each and every core had its power loss measured at 50Hz at sinusoidal flux densities up to 1.2 Tesla, using the feedback amplifier technique due to McFarlane and Harris[44].

The power loss of amorphous ribbon cores of Metglas 2605 SC was measured on annealed and unannealed samples with butt and lap corner configuration. The samples were stress-relief annealed at a temperature of 365°C for two hours in hydrogen and nitrogen.

The power loss of amorphous ribbon Metglas alloy 2605 CO was measured in two types of joint in the as-produced state:

(a) butt and lap joint,

(b) 45° mitred overlap joint.

A conventional M-OH grain-oriented silicon-iron core with butt and lap joints was built and tested in the as-produced state and the results were used for comparison with the ones obtained on amorphous metal stacked cores and sandwich cores.

Three sandwich cores using combinations of two different types of magnetic material were built for loss evaluation. Two used conventional M-OH grain-oriented silicon-iron and Metglas alloy 2605 CO laminations; one with 76.5% of grain-oriented silicon-iron M-OH and 23.5% of Metglas 2605 CO and another with the proportions equally shared. The third sandwich core was built with 55% of Metglas alloy 2605 SC and 45% of Conventional M-OH grain-oriented silicon-iron. All were tested in the as-produced state.

The results of this investigation showed that the stress-relief annealing of 'Metglas' amorphous magnetic materials in either nitrogen or hydrogen improved the efficiency; the 45° mitred overlap joint gave lower power loss than the butt and lap joint. The power loss in sandwich cores was higher than that in the cores built with only one type of material. Therefore, there is no commercial advantage to be obtained by using cores built with two different types of material.

INDEX