ELECTRICAL CONDUCTIVITY AND SKIN DEPTH IN ZINC OXIDE CERAMICS

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I. INTRODUCTION

Our purpose was to obtain information concerning non stoechiometric ZnO by means of E.S.R. measurement. Such information would be useful for varistors which are important electronic components.

II. SAMPLES PREPARATION

The samples were prepared by thermal treatment at 350°C from a pure stoechiometric ZnO powder. The non stoechiometric powder obtained, was pressed into disc and sintered at 1200°C.

III. DATA FROM ESR AT X-BAND

- At low temperature (fig. 1a) : the ESR spectrum shows a symetric line at g = 1.96 with a line width of 14 G. These values are consistent with the presence in the lattice of intersticial Zn^{+} and Zn^{2+} ions, producing an electron flow in the conduction band (1).

- At room temperature (fig. 1 b) : the ESR line shows the so-called Dysonian shape (2) confirming the presence of conduction electrons and pointing out the existence of the skin effect.

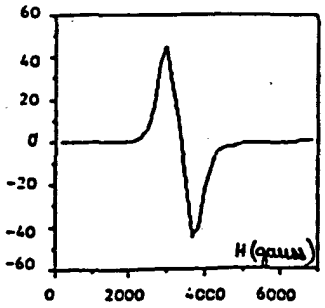

Fig. 1a

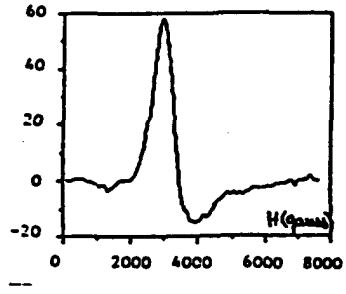

Fig. 1b

Fig. 1 : ESR line at T = 10 K (fig. 1a) and T = 300 K (fig. 1 b)

IV. THE SKIN DEPTH VALUE DEDUCED FROM DIRECT CURRENT METHOD

The resistivity of our sample is $\rho = 6\ \Omega \cdot cm$ resulting in $\delta = 1.4\ \mu m$.

V. THE SKIN DEPTH VALUE DEDUCED FROM ESR DATA

From the curve plotted in fig. 2 the value of the δ/d ratio at room temperature is seen to be $\delta/d = 0.48$.

If we adopt the crude value of the thickness of the sample we go to obtain the surprising value of 0.48 mm. But it is evidently necessary to use here the Emtage's assumption : in case of ESR measurement the microwave disturbance must be considered as impressed upon one grain. Using this assumption we obtain $\delta = 1.16\ \mu m$ in good agreement with the data deduced from D.C measurement.

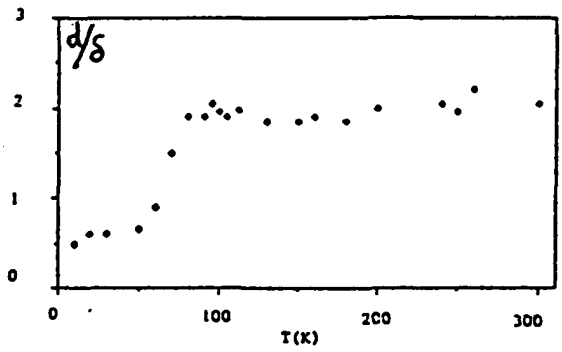

Fig. 2 : The relative skin depth ratio d/δ versus temperature

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