بسم الله الرحمن الرحيم

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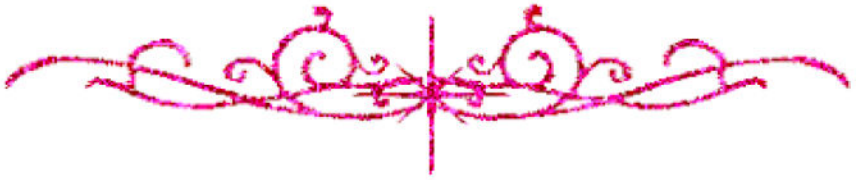

HOSSAM MAGHRABY

EFFECT OF LANTHANA AND NIOBIA ADDITIVES ON THE PHYSICAL PROPERTIES OF BARIUM TITANATE CERAMICS

A thesis

Submitted for the Degree of M. Sc in Physics

By

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(B. Sc) Physics

To

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1997

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Atif Mahmoud Ismail

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SUMMARY AND CONCLUSIONS

SUMMARY AND CONCLUSIONS

Barium titanate has been used as a multilayer ceramic capacitor due to its high dielectric constant and low dielectric loss. The aim of the present work is to investigate the effect of lanthanum oxide (La_2O_3) and niobium oxide (Nb_2O_5) additives on the physical properties of the ceramic $BaTiO_3$. Samples were prepared, using the ceramic technique, to obtain the composition $BaTiO_3 - La_2O_3 - Nb_2O_5$ (with $Nb_2O_5 = 0.1\,wt\%$ and $La_2O_3 = 0.0, 0.1,$ $0.2, 0.3$ and 0.4). The investigation included the study of the effect of La substitution and temperature on various properties. The structure of the samples have been confirmed by X-ray diffraction showing that beside the main tetragonal phase, there is a new phases due to the inhomogeneity of the dopants during preparation method. The lattice parameter, the density, X-ray density and porosity are determined as a functions of composition.

The dielectric constant have been measured in a wide range of temperature from room temperature to 200 °C for all compositions at constant frequency 1 KHz, also dielectric loss have been measured at the same frequency (1 KHz) from room temperature to 160 °C.

D. C. Resistivity have been measured in the temperature range 60 - 200 °C.

Thermal conductivity have been measured under vacuum from room temperature to 200 °C. The main conclusions can be summarized as follows :

1- The axial ratio (c / a), at room temperature, decreases initially with increasing lanthanum content up to $X = 0.2$ and then increases, this is due to La ions initially enter the lattice replacing Ba ions causing an increase in a parameter,