سامية محمد مصطفى

شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

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شبكة المعلومات الجامعية

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التوثيق الالكتروني والميكروفيلم

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سامية محمد مصطفى

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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بالرسالة صفحات لم ترد بالأصل

STUDY THE STABILIZATION OF MERCURY CUPRATE COMPOSITES (HG-1223)USING THALLIUM AND YTTRIUM

Thesis
Submitted to the Faculty of Science
Alexandria University
for the Degree of Master Science
in Physics

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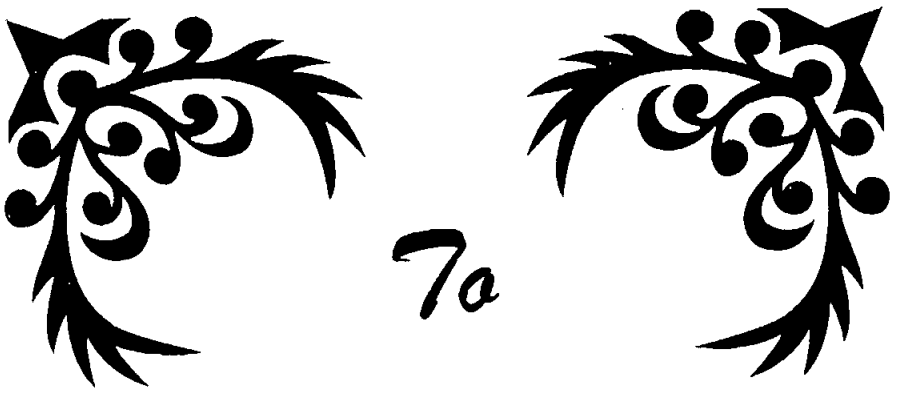

My Family

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The synthesis of Hg-cuprates at standard pressure is a difficult problem. This difficulty comes from the fact that an excess oxygen "δ" with respect to the ideal formula $HgBa_2Ca_{n-1}Cu_nO_{2n+2}$ is necessary to stabilize the structure. An interesting way to stabilize such structure deals with partial substitution of mercury (divalent) by foreign elements with a higher valance such a Bi (trivalent) or Tl (trivalent) and Pb (tetravalent).

In this work, the substitution of thallium for mercury and yttrium for calcium has been studied. A series of samples type $Hg_{1-x}Tl_xBa_2Ca_{1.8}Y_{0.2}Cu_3O_{8+\delta}$ for x=0.3, 0.5, 0.7, 0.9 and 1 have been synthesized at standard pressure, using the solid state reaction technique.

The structure of these samples is determined using X-ray diffraction. the data revealed that this structure is tetragonal unit cell with space group P4/mmm. The lattice parameters "a" and "c" are calculated. The lattice parameter "a" does not change by changing Tl content, whereas "c" is decreased with increasing of Tl content.

The scanning electron microscope (SEM) and micro probe analysis were done for some samples. The data of micro probe analysis shows that the thallium ions were successfully doped into this structure.

The investigation of the superconductivity is determined by the electrical resistance measurements as a function of temperature. The results showed that the transition temperature in (Hg, Tl)-1223 phase is varied from 122 K to 134 K. The temperature dependence of resistance is studied in a temperature range from 227 K down to the transition temperature. We found that the dependence of resistance on temperature is related to the equation Y=AT+B.

The effect of weak applied magnetic field (starting from 0 up to 4.9 kG) and driving current (from 10μA to 30 mA) on the transition behavior was studied. The data of applied magnetic field shows that the magnetic field does not affect on the first stage of transition, but it only affects on the second stage of transition. The transition width is increased by increasing the applied magnetic field. We also found that the effect of driving current is similar to the effect of magnetic field.

The effect of oxygen annealing at 300 °C for 6 hours on the samples was studied. This effect enhances the transition temperature for sample x=0.3 and decreases the transition temperature for other samples. This gives an idea about underdoped and overdoped samples.

CHAPTER I

INTRODUCTION

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Introduction

1-1 General review:

Superconductivity is the name to a remarkable combination of electrical and magnetic properties which appears in certain metals when they are cooled to extremely low temperatures. Such very low temperature first became available in 1908 when Kamerlingh Onnes at the university of Leiden succeeded in liquefying helium, and by its use was able to obtain temperature down to about 1 °K.

One of the first investigations which Onnes carried out in the newly available low-temperature range was a study of the variation of the electrical resistance of metals with temperature. It has been known for many years that the resistance of metals falls when they are cooled below room temperature, but it was not known to what limiting value the resistance would approach if the temperature is reduced towards 0 °K. Onnes experimenting with platinum, found that, when cooled its resistance fell to a low value which depended on the purity of the specimen. At that time the purest available metal was mercury and, in an attempt to discover the behavior of a very pure