## Abstract

In this work, both $YBa_2Cu_3O_{7-\delta}$ and $Y_3Ba_5Cu_8O_{18-\delta}$ superconductors were prepared in solid state reaction and sol- gel auto-combustion reactions, the study of the improvement of structural and electrical properties for two compounds, Replace the element (Y) by lead (Pb) and copper (Cu) of the compound ($Y_3Ba_5Cu_8O_{18-\delta}$) on the structural and electrical properties to obtain about the compound ($Pb_{1.5}Cu_{1.5}Ba_5Ca_5Cu_8O_{18-\delta}$) by preparing for both solid state and auto- combustion reactions.

Initially, the samples were prepared in solid state reaction by using appropriate weights of powder oxides. These powders were mixed with a two-hour by agate mortar and the powder mixture was compressed using the hydraulic piston under a load (7ton ) for (3) minutes and weighed (2g)

,The samples were sintered at a temperature of (850OC) for (24 hr) and a heating rate of (5 OC / min) to ensure the propagation process and to obtain a coherent material and then to cool the samples at the same rate of heating.

In the second stage, the samples of the above compounds were prepared sol- gel auto-combustion method. Yttrium oxide, nitric acid, lead nitrate, copper nitrate, calcium nitrate, barium nitrate, and citric acid were used with suitable weight, The resulting powder was obtained from the incineration process, which was burned for (4 hr). The powder was then weighed and compressed under a load (7ton) for (3) minutes and weighed (2g). The nanocrystalline powder obtained from the burning process The samples were sintered at ($850^oC$) for (48 hr) after adding a suitable amount of HgO powder for $YBa_2Cu_3O_{7-\delta}$ and $Y_3Ba_5Cu_8O_{18-\delta}$ to add and arrange the oxygen inside the installation.

The results of x-ray diffraction tests (XRD) were analyzed. Both the type of structure and the (a ,b , c) and the size of the cell unit were determined and the size of the crystal was determined by Debye Scherer and Williamson-hall Where the results indicate that the compounds (Y123) and (Y358) have the existing structure of the existing (Orthorhombic) by the two methods. The compound ($Pb_{1.5}Cu_{1.5}Ba_5Ca_5Cu_8O_{18-\delta}$) has tetragonal structure and is prepared in both methods, it was also found that the size of the crystal calculated by the Williamson-Hall equation is

slightly larger than that calculated by the Scherer equation (Debye- Scherer) and for both methods. The surface of the samples was examined by the electronic scanner (SEM) of the compounds ($YBa_2Cu_3O_{7-\delta}$) and ($Y_3Ba_5Cu_8O_{18-\delta}$) prepared by the sol-gel method auto- combustion, the particle size was a few microns. The electrical

resistivity was measured and the critical transition temperature at which zero electrical resistivity was determined ($\rho = 0$). The results showed that the compound ($Pb_{1.5}Cu_{1.5}Ba_5Ca_5Cu_8O_{18-\delta}$) possessed the highest critical temperature (122k) prepared by the sol-gel with combustion method. The compounds Y123 and Y358 possess critical temperatures (95k, 105k), respectively, and are prepared in the sol-gel method with auto- combustion method, Dielectric constant (real & imaginary) ,loss tangent and alternating electrical conductivity) were studies by examining the LCR-Meter at room temperature of the frequency and range (5KHz - 1MHz) and the effect of substitution on these properties ,where the results showed that the dielectric constant (real & imaginary) ,Loss tangent for all the compounds that were prepared decreased with increasing frequency and both methods. The alternating conductivity increases with increasing frequency of the same prepared samples for both methods. Finally, the oxygen content of each of the prepared compounds was measured and measured by auto-combustion method. We note the compound ($Pb_{1.5}Cu_{1.5}Ba_5Ca_5Cu_8O_{18-\delta}$) has the highest oxygen content of the other two compounds (0.068548)، The compounds (Y123) and (Y358) have oxygen content(0.011198 , 0.054857) respectively.