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Dependence of Superconducting Properties of $YBa_2Cu_3O_{7-\delta}$ - crystal on the Structure of the Crystal Lattice

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High-temperature superconductors are a family of materials (superconducting ceramics) with a common structural feature that can be characterized by relatively well-defined copper-oxygen planes.

It is known that the crystal structure of $YBa_2Cu_3O_{7-\delta}$ - crystal is arranged in such way that the Cu-O-Cu chains are elongated parallel to each other along the direction of the b - axis. The structure and properties of$YBa_2Cu_3O_{7-\delta}$ - crystal are directly related to the index characterizing the content of oxygen vacancies. Compounds are superconducting and have orthorhombic symmetry (superconductors) at $\delta < 0.4$.

At $\delta > 0.4$, they become semiconductors with tetragonal symmetry. When heated, compounds lose oxygen, and annealing in an oxygen atmosphere is necessary to optimize them for the oxygen composition and superconducting characteristics. Upon transition from the tetragonal modification to the rhombic $YBa_2Cu_3O_{7-\delta}$ - crystal, along with a change in oxygen stoichiometry, the oxygen sublattice undergoes rearrangement. Vacuum annealing reduces oxygen in the system, thus increasing superconducting properties.

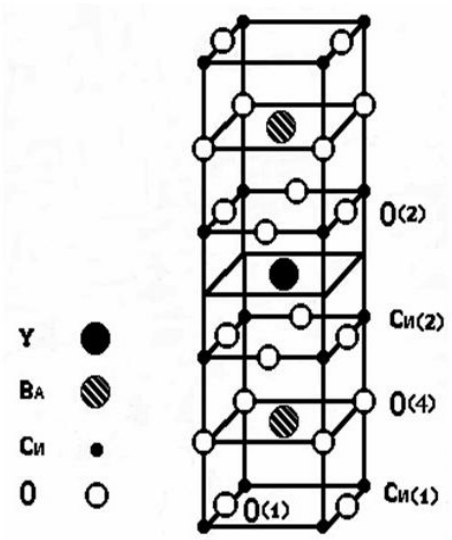

Fig. 1 The structure of the superconductor crystal of $YBa_2Cu_3O_{7-\delta}$

The influence of changes in the crystal lattice structure of the high-temperature superconductor of $YBa_2Cu_3O_{7-\delta}$ - crystal on the conductive properties has been studied in this work. It was found that oxygen separation at 200 and 300°C in the non-stoichiometric compound of $YBa_2Cu_3O_{7-\delta}$ - crystal, regardless of the oxygen content (δ = 6.8-6.22), begins with the formation of particles enriched in oxygen orthophase in an oxygen-depleted matrix. A change in the amount of CuO in the test sample can change the value of the critical current, which may occur due to the appearance of nanoparticles on the surface of superconducting granules.

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