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Abstract

The investigations of superconducting state properties of selected cuprates and iron chalcogenides, including those intercalated with organic compounds

The determination of superconducting state parameters – the upper critical field H_{c2}, the lower critical field H_{c1}, the irreversibility field H_{irr}, and related coherence length ξ and field penetration depth λ – remains as an extremely important task, since they well enough describe the macroscopic and microscopic properties of superconductors and the limits of materials applicability. In presented thesis the superconducting state properties of copper-based $CuBa_2Ca_3Cu_4O_{10+\delta}$ and iron-based $Li_x(C_2H_8N_2)(Fe_ySe_zS_{1-z})$ systems are studied by means of SQUID magnetometry using both dc and ac measurement technique.

It is established that $CuBa_2Ca_3Cu_4O_{10+\delta}$ synthesized by high-pressure and high-temperature method possesses the upper critical field H_{c2} as high as 91 T at the liquid nitrogen boiling temperature (77 K), meanwhile the irreversibility field of about 21 T at the same temperature pronounces the existence of vortex liquid state over the wide range of fields. There is considered the influence of granularity on the ratio of intragranular and intergranular critical current density. Apart from strongly inhomogeneous nature of the material, its very big zero-temperature H_{c2} and related small zero-temperature ξ of about 186 T and 1.33 nm, respectively, indicate high possible pinning abilities and the efficiency of intentionally introduced point defects.

The $Li_x(C_2H_8N_2)(Fe_ySe_zS_{1-z})$ materials of different stoichiometric ratio obtained within the three approaches of solvothermal method reveals weak crystallinity, big amount of magnetic impurity phases and inhomogeneity of superconducting phase. There is observed the tending to mask screening abilities of the material by magnetic phases presence. That leads to impossibility of dc magnetometry technique utilizing. Uniquely proposed using of ac susceptibility measurements realized in external dc bias field is applied in order to study the $H_{c2}(T)$ phase diagram.

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