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The effect of titanium and oxygen on Fe Te Se superconductors

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Since the discovery of Fe-based superconductors, muchefforts have been focused on search for new superconductivity in related compounds. The aim of this work is to minimize the amount of iron oxide phase in Fe (Se,Te) superconducting materials by titanium doping. We have chosen material Fe1.02 Se0.5 Te0.5 as initial because of the highest Tc in the range of Fe (Se,Te) materials. Polycrystalline samples with nominal compositions Fe1.02 TixTe0.5 Se0.5 were prepared by a solid state reaction method. The samples were characterized using x-ray diffraction (Bruker D8 ADVANCE), EDS analysis (AURIGA Crossbeam Workstation, Carl Zeiss), electrical resistivity and magnetization measurements (MPMS XL7 EC, Quantum Design). Electrical resistivity of the samples has been measured two times: the first time immediately after preparation and the second one after one week stay on the air. We found that increase of titanium content leads to the decrease of the Tc for the first time. After one weak on air the Tc becomes higher and increases together with titanium content. The possible explanation is the formation of titanium oxide except iron oxide during the preparation and formation of iron oxide with excess iron during the stay on the air. The results of research were obtained in the framework of the state assignment of the Ministry of Education and Science of Russia.

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Determination of the line irreversibility in the new superconductor system $Lu_{3-x}Ga_xBa_5Cu_8O_y$ (x=0, 1.2, 1.5 y 3)

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The irreversibility properties of high-Tc superconductors are of major importance for technological applications. For example, a high irreversibility magnetic field is a more desirable quality for a superconductor. The irreversibility line in the H–T plane is constituted by experimental points, which divides the irreversible and reversible behaviour of the magnetization. The irreversibility lines for series of $Lu_{3-x}Ga_xBa_5Cu_8O_y$ (x=0,1.2, 1.5 y 3) polycrystalline samples with different doping were investigated. The samples were synthesized using the usual solid estate reaction method. Rietveld-type refinement of x-ray diffraction patterns permitted to determine the crystallization of material in a tetragonal structure. Curves of magnetization ZFC–FC for the system $Lu_{3-x}Ga_xBa_5Cu_8O_y$, were measured in magnetic fields of the 10–20,000 Oe, and allowed to obtain the values for the irreversibility and critical temperatures. The data of irreversibility temperature allowed demarcating the irreversibility line, T_{irr} (H). The obtained results allow concluding that in the system $Lu_{3-x}Ga_xBa_5Cu_8O_y$ presented a characteristic bend of the Almeida– Thouless (AT) tendency dominant for low fields and a bend Gabay–Toulouse (GT) behavior for high magnetic fields. This feature of the irreversibility line has been reported as a characteristic of granular superconductors and it corroborates the topological effects of vortexes mentioned by several authors.

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