Сейфуллин оқулары – 18(2): «XXI ғасыр ғылымы – трансформация дәуірі» халықаралық ғылыми -практикалық конференция материалдары = Материалы международной научно-практической конференции «Сейфуллинские чтения – 18(2): «Наука XXI века - эпоха трансформации» - 2022 .- Т.I, Ч.IV. – P.244-245

SYNTHESIS AND RESEARCH OF CERAMIC SUPERCONDUCTORS BASED ON AMORPHOUS PRECURORS

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The study of the effect of ceramic superconductor synthesis conditions on the phase composition and properties of HTSC revealed certain advantages of the glass-crystal method of obtaining precursors by melt quenching, which adds to the key parameters of superconducting ceramics. Advantages of this method include increased mutual solubility of components, possibility to tune grain size by choosing the optimal heat treatment mode, increased critical current due to metastable initial state of precursors and possibility to create texture. An analysis of the works shows that the rate of formation of the superconducting phase can vary several-fold depending on the synthesis method of the initial precursors. As well as melting the bar in a special muffle furnace, providing melting of the initial melt sample that diffuses directly from the surface bar to the hardening unit. Subsequently, the synthesis of ceramics is carried out according to the traditional ceramic process[1].

Fig. 1 Initial Precursors Obtained by Ultrafast Melt Quenching

In this regard, in order to study the effect of the synthesis conditions of the initial precursors on the superconducting phase formation rate, we put the precursors of $Bi_{1.6}Pb_{0.4}Sr_2Ca_2Cu_3O_y$ (2223) and $Bi_{1.6}Pb_{0.4}Sr2Ca_4Cu_5O_y$ (2245) in a muffle furnace at 850 °C , respectively, for 96 hours (pulverize once every 24 hours and then put it in the furnace) [2]. X-ray diffraction is performed every time between 24 ~ 96 hours, and then the influence of the critical temperature of the work on the resistance is detected. When the temperature is 80 ~ 110K,the resistance is the lowest and the effectiveness is the best.The experimental results show that superconducting materials can form phases at 850 °C, and the chemical composition, temperature and time all affect the properties of the phase . When we raised the oven temperature to 855°C, the tablets melted, explaining how even a small high temperature can have a big effect [3]. During the study, the 2223 and 2245 phases exhibited superconductivity in the temperature range of 110K to 80K, which proved that the $Bi_{1.6}Pb_{0.4}Sr_2Ca_{n-1}Cu_nO_y$ compound had the best electrical conductivity in the temperature range of 80K to 110K .

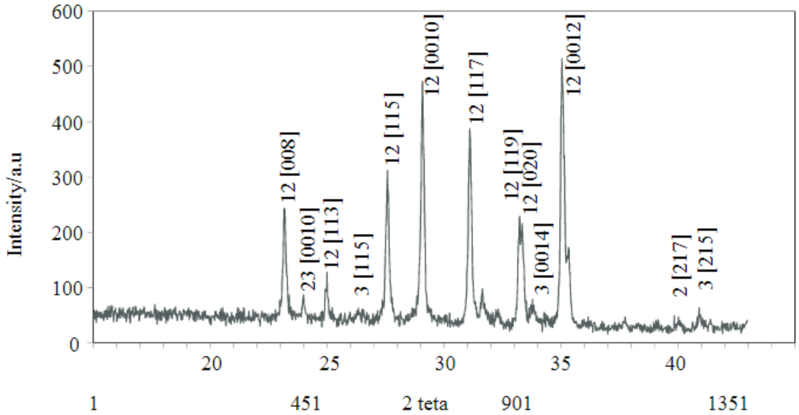

Fig. 2 X-ray diffraction pattern of the superconducting ceramic with the composition $Bi_{1.6}Pb_{0.4}Sr_2CaCu_2O_y$ obtained at 845 °C for 96 h

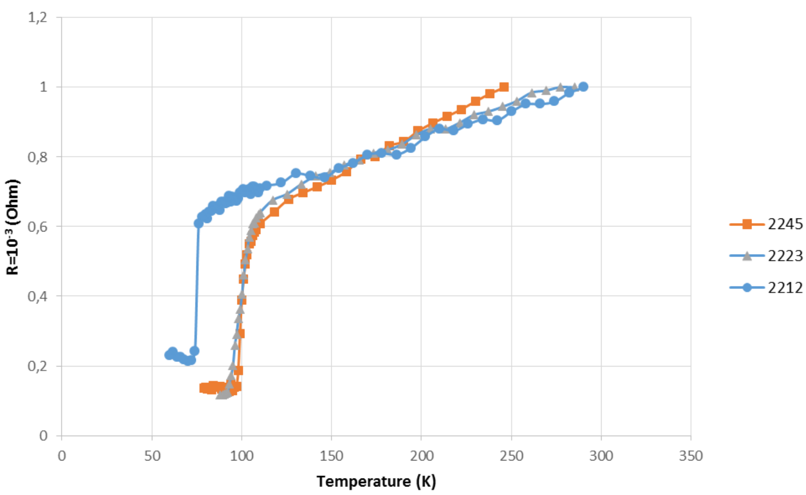

Fig. 3 Results of a temperature-dependent study of the electrical resistance (critical temperature) of the superconducting ceramic composition $Bi_{1.6}Pb_{0.4}Sr_2Ca_{n-1}Cu_nO_y$ (n = 3, 5) sample.

At the same time, it was found that the formation rate of HTSC phases 2223 and 2245 was increased by 1.5 ~ 2 times compared with melting in corundum crucible, and contamination of the material was excluded. The study also identified the kinetics of superconducting phase formation and differences in key parameters of HTSC ceramic samples.Our research will continue to evolve, we will achieve better results through non-stop research, and we will share more good news.

References

1 Uskenbayev D.E., Nogay A.S., E B Aynakulov. [Properties of Bismuth-Based Superconductors Precursors obtained under the influence of the Radiant Flux]. IOP Conf. Series]: Materials Science and Engineering ，012030 (2016)-110.

2 D. Larbalestier[High-T c superconducting materials for electric power applications.et al] :Nature. -2001. V. 414. - №6861. - P. 368.

3 Q. Y. Chen, Z. Xia, K. B. Ma, C. K. McMichael, M.Lamb, R. S. Cooley, P. C. Fwler, and W. K. Chu, [Appl.Supercond]: -1994. - P. -457 .