The synthesis of YBa$_2$Cu$_3$O$_{7-\delta}$ nanocrystalites via mechanochemical alloying & study transition temperature of xMnO$_2$ + (1-x) YBa$_2$Cu$_3$O$_{7-\delta}$ compounds

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Abstract: In this research, YBa$_2$Cu$_3$O$_{7-\delta}$ (0 < \(\delta\) < 1) nanocrystalite superconductor was prepared by mechanochemical alloying method. We synthesized YBa$_2$Cu$_3$O$_{7-\delta}$ via mixing the BaCO$_3$, Y$_2$O$_3$, CuO powders and milling in SPEX 8000 for 5h with weight ratio of ball to powder 10:1 and steel balls of 11mm diameter, followed by heating for 4h at 850 °C. The superconductor phase formation process was completed with sintering treatment under oxygen partial pressures. The superconducting transition temperature of the samples was investigated using the four-probe method. Then transition temperature of xMnO$_2$ + (1-x) YBa$_2$Cu$_3$O$_{7-\delta}$ compounds was studied. The superconducting transition temperature of the final samples with x = 0, 0.005, 0.01 is found to be 83 K, and for the samples with x > 0.015, the superconductivity was vanished.

Keywords: Superconductivity; YBa$_2$Cu$_3$O$_{7-\delta}$; Mechanochemical; MnO$_2$; Transition Temperature.

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