

UNIVERSITI TEKNOLOGI MARA

**EFFECTS OF NANOMETER $\gamma\text{Al}_2\text{O}_3$
ADDITION ON SUPERCONDUCTING
PROPERTIES OF $\text{Bi}_{1.6}\text{Pb}_{0.4}\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_x$
(Bi-2223) SUPERCONDUCTOR**

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ABSTRACT

Copper oxide based superconductor Bismuth (Bi, Pb)SrCaCuO or well known as (BSCCO-2223) with nano- $\gamma\text{Al}_2\text{O}_3$ addition have been prepared via co-precipitation (COP) method. The precursor powder was prepared using COP method while addition of nanoparticles $\gamma\text{Al}_2\text{O}_3$ was done through solid state reaction method. Four point probe, X-ray diffraction (XRD), energy dispersive analysis (EDAX) and scanning electron micrograph (SEM) have been used to characterize the materials. By COP method, the precursor was fabricated into bulk samples and the addition of nano- $\gamma\text{Al}_2\text{O}_3$ is between 0.0 wt% -1.0 wt % from molecular weight of sample. All prepared samples have been sintered in various sintering duration of 12, 24, 36, 48 and 56 hours at 850°C, respectively. The focus of investigation is on critical transition temperature (T_c), critical current density (J_c), Bi-2223 phase percentage and microstructure development. All four characteristics have been studied for each experimental sample. Sample with addition 0.7 wt% of nano- $\gamma\text{Al}_2\text{O}_3$ and sintered at 48 hours shows maximum J_c value of 9.78 A/cm² with T_c of 101 K. J_c value depends on sintering duration. Sample sintered for 12 hours at 850°C did not show superconductivity properties very well. The J_c obtained is 3.7 A/cm² and the T_c is lower than 90 K. The COP method has shown to produce high percentage of Bi-2223 superconducting phase. A small addition of nano- $\gamma\text{Al}_2\text{O}_3$ is found to improve the Bi-2223 phase where intergrains connectivity is enhanced and weak links are reduced, resulted in enhanced J_c value. Larger grains size is observed with increasing sintering time as manifested in samples sintered at 56 hours. In COP prepared samples, the nanoparticles act as pinning flux centre under certain condition.

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