

## Threshold of the twin boundaries in micro-nanoparticles of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ superconductor

M. Mohammadi<sup>\*1</sup>, B. Khoshnavisan<sup>2</sup>

1- Department of Physics, Faculty of Science, Qom University of Technology, Qom, Iran

2- Faculty of Physics, University of Kashan

(Received: 30/4/2018, in revised form: 15/8/2018)

**Abstract:** Twinning is one of the main mechanisms of plastic deformation in crystals and its effect on the empirical properties has been important in materials science. Twin boundaries have been proved to be effective flux pinning centers in YBCO that increasing the critical current density. High-temperature superconductor  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$  (YBCO) nanoparticles were prepared by solid state alloying method. The phase formation and microstructure of the bulk and nano powders of YBCO were studied, using Rietveld refinement and Williamson–Hall (W–H) analysis. We estimated the critical length scale around 250 nm when it will be still energetic to create twins instead of remaining elastically strained and twin less. The synthesis YBCO powder has very small grains with the size about a few (30-40) nano meters. The microstructure analysis shows that the obtained YBCO powders have very fine grains with a size around several tens of nanometers. Twin boundaries did not observe in YBCO nanocrystalites. Therefore, designing of twin microstructure and effective control of the particles size in YBCO, has an effect directly on the critical current density of the samples that are important for its commercial exploitation.

**Keywords:** *Twin boundaries; high-temperature superconductor nano particles; Rietveld refinement; Williamson–Hall (W–H) analysis.*

متن فارسی اصل مقاله از صفحه ۲۵۵ تا ۲۶۲ در این شماره به چاپ رسیده است.

---

\*Corresponding author; Tel: 09356348058, Email: mohammadi.m@qut.ac.ir