Modeling of the reversible effect of axial strain on the critical current of polycrystalline YBCO coated conductors

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Abstract

YBCO coated conductor, as the 2nd high temperature superconductor, has many potential applications due to higher carrying capability. In practice, the strong effect of applied strain on the critical current of YBCO coated conductors has been observed. As the irreversible strain being a limit, When the strain is relatively smaller, the varying of the critical current is reversible. Our work is here mainly focused on the reversible effect of axial strain on the critical current of YBCO superconductor film. A 2-D model which is able to consider the strain effect has been built by improving the LP(Limiting Path) model. Based on the change law of critical current density of single grain and single grain boundary in bicrystal under strain, the reversible change law of the critical current of polycrystalline YBCO superconductor film under the effect of axial strain which will not lead the film to fracture can be got by the model. The residual strain which generates in the productive process of polycrystalline YBCO superconductor film can be considered in the model and the calculated result of the model can directly show the effect of residual effect on the critical current of the film. The mechanism of the reversible effect of axial strain on the critical current of polycrystalline YBCO superconductor film by comparing the calculated result of the model with experiment data has been discussed. By comparing the calculated result of the model of the film with different texture, an effect of film texture on the reversible effect has been found.

Keywords:
Polycrystalline YBCO coated conductor, axial strain, reversible effect, critical current