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Mechanical behavior in superconducting composite wires

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Abstract

Numerical calculations of mechanical behavior in multi-filamentary Ag-alloy sheathed Bi-2212 superconducting round wires and cables are presented in this paper. Bi-2212 composite wires possess excellent current carrying capabilities even in magnetic field. The strain may lead to the degradation of critical current density. And the filament fracture caused by strain is a key issue to the application of superconductor. Due to the complex nonlinear electromagnetic characteristics of superconductor, we use the variational formulation based on the field-dependent critical state model to calculate the distributions of current and magnetic field in Bi-2212 composite superconducting wires and cables. The finite element method (FEM) is employed in the calculation of mechanical behavior. We have developed a numerical method by combining the variational formulation and FEM to calculate the two-dimensional electro-mechanical problem. The strain and stress distribution in infinity long Bi-2212 single wire, two wires, 6-around-1 cable and Rutherford cable carrying transport current in external magnetic field are calculated. The possible damage position in wires and cables is discussed.