Transient Behaviors of Melt Processed Superconductors with Artificial Holes during the Cooling in Liquid Nitrogen

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Temperature distributions and thermal stresses were calculated and analyzed to investigate the effect of the artificial holes to the transient behaviors of the superconductors which was cooled in liquid nitrogen. Three dimensional finite element methods were used to calculate the transient temperature and thermal stresses in the superconductors. The cooling speed of the superconductors with holes is faster than those without holes. Because the thermal stresses calculated in the superconductors can be relaxed by the distributed holes, the volume of the peak tensile stress decreases during the cooling in liquid nitrogen. If optimal metal, which can maintain the relaxation of thermal stresses, is used to fill and reinforce the artificial holes, the probability of failure of the superconductors may be decreased by the decrease of volume of peak tensile stress.