Relation Between Transverse and Longitudinal Normal Zone Propagation Velocities in Impregnated MgB_2 Windings

Antti Stenvall, Risto Mikkonen, and Pavol Kovác

Abstract—The transverse normal zone propagation velocity, v_t, inimpregnated magnets controls the 3D normal zone expansion during a quench. It is dominated by the thermal conductivities of the conductorinsulation and the impregnation material. The longitudinal propagation velocity v_l is mainly determined by the heat generation, critical surface of the superdoncutor and thermal conduction along the conductor. It has been generally assumed that the ratio v_t/v_l is proportional to the the square root of the ratios of the corresponding effective heat conductivities. In this paper we study computationally the validity of this approach for an MgB_2 wire surrounded by an epoxy layer. We take into account the finite n-value of the composite conductor in our Finite Element Method (FEM) models. We computed v_l with Whetstone-Roos formula and 1D and 2D FEM models. The 2D model was also used to compute v_t. In addition to this, minimum quench energies given by the1D and 2D FEM models were compared.

Index Terms—finite element method, MgB_2, normal zone propagation velocity, simulation

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A.Stenvall and R.Mikkonen arewith Tampere University of Technology, Electromagnetics, P.O. Box 692, FIN-33101 Tampere, Finland (phone:+385-3-31152080;fax:+358-3-31152160;email: antti@stenvall.fi; www:http://www.tut.fi/smg).
P.Kovác is with Institute of Electrical Engineering, Slovak Academy o fSciences, D´ubravskacesta 9,84104 Bratislava, Slovakia.