FABRICATION AND CRITICAL CURRENT DENSITY STUDIES OF DIP COATED MULTI-CORE HIGH-TEMPERATURE SUPERCONDUCTOR TAPES

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DECEMBER 2005

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Tarikh : 3 April 2002

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Tuan

KEPUTUSAN MESYUARAT JAWATANKUASA PENYELARAS IRPA 1/2002 – TAHNIAH !

Keputusan Mesyuarat Jawatankuasa Penyelaras IRPA bil. 1/2002 yang telah diadakan pada 14 Mac 2002 adalah berkaitan.

Dengan sukacitanya BRC ingin mengambil kesempatan di sini untuk mengucapkan syabas dan tahniah atas kejayaan tuan. Tajuk projek tuan yang telah diluluskan adalah

Fabrication and Critical Current Density Studies of Dip-Coated Multi-Core High-Temperature Superconductor Tapes [geran sebanyak RM199,900.00].

Sila berurusan dengan Penolong Pendaftar BRC untuk urusan perjanjian.

Yang benar

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/rmi:Keputusan Mesy IRPA 1/2002

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ABSTRACT

In this work Tl1212/Ag tapes were fabricated using superconducting powders prepared from different nominal compositions and subjected to a combination of thermal and mechanical treatments. The effect of the thermo-mechanical treatments on transport critical current density (J_c) in zero field and in low external magnetic fields was investigated. The superconducting core of the tapes were made of Tl-1212 powder prepared from $Tl_{0.9}Bi_{0.1}Sr_{1.9}Mo_{0.1}Ca0.9Y_{0.1}Cu_2O_7$, $Tl_{0.9}Cr_{0.1}Sr_2Ca_{0.9}Pr_{0.1}Cu_2O_7$, $Tl_{0.5}Pb_{0.5}Sr_{1.8}Yb_{0.2}CaCu_2O_7$ nominal composition which were synthesized by conventional solid state technique and $Tl_{0.8}Bi_{0.2}Sr_2Ca_{0.8}Y_{0.2}Cu_2O_7$ nominal composition synthesized by co-precipitation method. It was observed that different thermo-mechanical treatment on the tapes resulted in different values of J_c. J_c enhancement was observed for tapes annealed at temperatures $\geq$ 870 °C in combination with intermediate mechanical rolling. Generally the J_c's observed for Tl1212/Ag tapes using conventional-solid-state derived superconducting powder were between 500-600 A/cm^2. For multi-core $Tl_{0.5}Pb_{0.5}Sr_{1.8}Yb_{0.2}CaCu_2O_7$ tapes, J_c was generally found to increase with number of core. For $Tl_{0.8}Bi_{0.2}Sr_2Ca_{0.8}Y_{0.2}Cu_2O_7$ tapes fabricated using co-precipitation derived powder, the highest transport J_c of 6,538 A/cm^2 at 40 K in zero field was achieved for the tape annealed at 870°C for 60 minutes. The higher magnitude of J_c is attributed to enhanced grains contact within the oxide core of the tapes as observed from its partial melted microstructure. However, for multi-core $Tl_{0.8}Bi_{0.2}Sr_2Ca_{0.8}Y_{0.2}Cu_2O_7$ tapes, J_c was found to decrease with number of core. The

magnetic field dependence of J_c for most tapes exhibited weak links dominated behavior for low fields (B< 0.1-0.2 T) and strong link transport behavior at higher fields. The major cause for the low J_c observed for the dip-coated tapes are believed to be mainly due to absence of favourable texturing of the tapes core. However, the J_c values for the tapes in this study are comparable to previously reported J_c values of Tl1212/Ag tapes fabricated via the oxide powder-in-tube method.