High Energy Ball-Milling and Synthesis Temperature Study to Improve Superconducting Properties of MgB_2 *ex-situ* Tapes and Wires

Gennaro Romano, Maurizio Vignolo, Valeria Braccini, Andrea Malagoli,
Cristina Bernini, Matteo Tropeano, Carlo Fanciulli, Marina Putti and Carlo Ferdeghini

Abstract—MgB_2 monofilamentary nickel-sheated tapes and wires were fabricated by means of the ex-situ powder-in-tube method using either high-energy ball milled and low temperature synthesized powders. All samples were sintered at 920°C in Ar flow. The milling time and the revolution speed were tuned in order to maximize the critical current density (J_c) in field: the maximum J_c value of 6 x 104 A/cm^2 at 5K and 4T was obtained corresponding to the tape prepared with powders milled for 144h at 180rpm. Various synthesis temperature were also investigated (730-900°C) finding a best J_c value for the wire prepared with powders synthesized at 745°C. We speculate that this optimal temperature is due to the fluidifying effect of unreacted magnesium content before the sintering process which could better connect the grains.

Index Terms — critical current, magnesium diboride, ex-situ, high energy ball-milling, synthesis temperature

Manuscript received 19 August 2008.
This work was supported in part by the Columbus Superconductors S.p.A and by MIUR under the project FIRB-MAST (RBIP06M4NJ).We thank also the Compagnia di S. Paolo for the financial support.
G. Romano,M Tropeano, C. Fanciulli, M. Vignolo, A. Malagoli, V. Braccini,C. Bernini, M. Putti and C. Ferdeghini are with CNR-INFM LAMIA, C.so Perrone 24, 16152 Genova, Italy (phone: +39-010-6598789; fax: +39-010-6598732; e-mails: maurizio.vignolo@infm.it, romano@fisica.unige.it, malagoli@lamia.infm.it,carlo.fanciulli@infm.it, braccini@lamia.infm.it; cristina.bernini@infm.it; tropeano@fisica.unige.it, amartin@chimica.unige.it; putti@fisica.unige.it, ferdeghini@fisica.unige.it