A NOVEL PROCESSING ROUTE FOR FABRICATION OF THE HIGH TEMPERATURE $YBA_2CU_3O_{7-x}$ SUPERCONDUCTOR

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ABSTRACT

The capability of operating at liquid nitrogen temperatures and at high magnetic fields offers the new oxide superconductors significant advantages over the conventional low temperature metallic superconductors. The benefits include lower operating costs, simplicity in fabrication and maintenance, and novel applications. The commercial applications of the high temperature superconductors can be accelerated if low values of critical current density and mechanical properties can be improved. These low property values are not inherent in the starting powder but reflect the non-optimal processing conditions presently used for the fabrication of bulk shape superconductors.

An alternate processing route using the Ceracon Technology, has been developed for rapid consolidation of the $YBa_2Cu_3O_{7-x}$ superconductors and is presented. This process employs conventional P/M equipment and easily lends itself to automation. Bulk shapes such as solid and hollow cylinders, large diameter discs and spheres have been consolidated to consistently yield densities in the range of 93-98% of the theoretical. Densification is achieved in minutes while preserving the original composition and microstructure. Ceracon processed bulk superconductors are being considered for applications such as sputtering targets for thin film processing, magnetic shields, microwave cavities, accelerometers and gyros. Results on density, microstructure, superconducting properties and phase analysis through XRD are presented. The Ceracon Process is evaluated with respect to existing competing processes as an industrial P/M consolidation technique.

INTRODUCTION

The discovery of the superconductivity in ceramics has triggered off an intense research aimed at improving the following properties: transition temperature (the temperature at which the materials attain the state of perfect diamagnetism and zero resistance, T_c); the critical current density (the amount of current the superconductor can handle without losing its superconducting