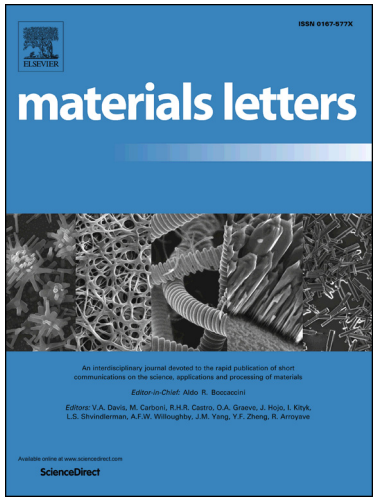

Improved superconducting properties for multifilament graphene-doped MgB_2 wires by an internal Mg diffusion process

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Improved superconducting properties for multifilament graphene-doped MgB_2 wires by an internal Mg diffusion process

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Abstract: We have fabricated 6+1-filament MgB_2 wires using an internal Mg diffusion (IMD) process. For the 3 at% graphene (G) doped long wire with 1.4 mm diameter, the critical current is about 530 A at 4 T, which is 45% higher than that of the undoped sample. Moreover, the G doped wire has higher irreversible strain of 38% in comparison to the undoped one of 30% after 650 ^{o}C×2 h annealing. The obtained results show that the G doped IMD wires with excellent superconductivity and mechanical property can compete with the conventional PIT wires in practical application.

Keywords: Ceramics, Metalic composites, Microstructure, Functional, IMD.

1. Introduction

MgB_2 has the highest critical temperature (T_c) of 39 K compared with metallic superconductors [1]. In contrast to high-temperature superconductors, the weak-link problem of MgB_2 is less, so it is available in long length [2]. In addition, the raw material of MgB_2 is significantly cheaper. The MgB_2 wires can be fabricated by low cost process and simple heat treatment. Therefore, MgB_2 appears to be a promising superconducting material for large scale applications. However, the critical current density is still unsatisfactory for MgB_2 wires.

The powder in tube (PIT) process is the traditional method for fabricated MgB_2 wires. The PIT process can be classified as *in-situ* method and *ex-situ* method depending on the starting powders employed. The *in-situ* method has a porosity problem due to the reaction between the Mg and B powders, whereas the *ex-situ* method has a low intergrain connectivity problem because MgB_2 is a hard ceramic [3].