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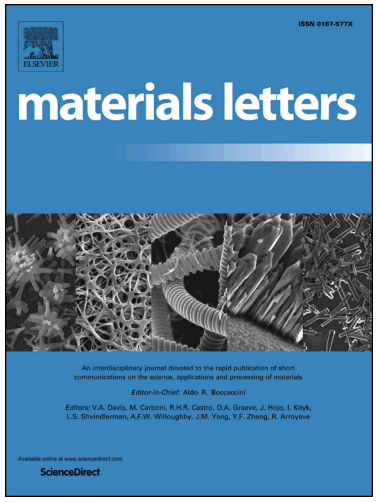

Microstructure and mechanical properties of magnesium silicide prepared via spark plasma assisted combustion synthesis

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Microstructure and mechanical properties of magnesium silicide prepared via spark plasma assisted combustion synthesis

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Abstract

The current study reports the swift synthesis of high strength nanocrystalline magnesium silicide (Mg_2Si) doped with bismuth (Bi) of 0-0.025 at.% via spark plasma assisted combustion synthesis. The proposed synthesis approach is rapid (54 min) against the conventional liquid and solid state synthesis routes which warrants prolong duration. XRD and TEM studies reveal the *in-situ* evolution of Mg_2Si phase and substantial doping of Bi. The synthesized Mg_2Si compound exhibits higher density (>95). $Mg_2Si_{0.975}$-$B_{0.025}$ demonstrates the benchmarked Vickers hardness of 484.2±15.44 Hv_1 and un-doped Mg_2Si shows the excellent fracture toughness of 2.09±0.03 MPa√m.

Keywords: Magnesium silicide; combustion synthesis; Electron microscopy; X-ray techniques; Spark plasma sintering; Mechanical properties.

1. Introduction

Thermoelectric (TE) technology is being received the tremendous attention in the field of energy conversion and cooling applications due to its unique traits such as functional simplicity, noiseless, cost-effective, zero maintenance, eco-friendly etc.,[1]. Among various TE materials, the greater interest is being focused on magnesium silicide (Mg_2Si) for their proven potential towards the development of new class of environmentally conscious and scalable thermoelectric