

絹雲母及絹雲母/氮化硼複合材料添加物應用於導熱工程塑料之研究

Study of Thermally Conductive Plastic Using Sericite Mica and Sericite Mica /Boron Nitride Composite Fillers

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摘 要

同時具備導熱及電器絕緣之電子產品封裝材料需求量日益增加，而在人工合成導熱陶瓷粉末中以氮化硼粉末之熱性質及低硬度特性最為適合作為導熱塑料之添加材料，但由於氮化硼之價格昂貴且於塑料中分散不易，使得氮化硼遲遲無法大量應用於導熱塑料製作。本篇研究則是利用天然絹雲母材料 (KF-2000) 及絹雲母/氮化硼複合材料 (CB-560、CB-680、及 CB-890) 作為工程塑膠之添加材料，大幅降低原料成本，可提升填充材料於塑料中之分散性，並且以定性及定量方式證明複合塑料之熱性質遠優於純塑膠材料 (熱傳導係數增至 2~3 倍、熱擴散係數增至 3~5 倍、及熱容只有 ~1/2 倍)。

關鍵詞：絹雲母、氮化硼、複合塑膠、導熱塑料、熱管理。

Abstract

The demand of thermal insulating plastics as package materials is rapidly increases. Boron nitride(BN), which has the properties of high thermal conductivity and low hardness, is the best candidate as the thermal conductive filler of composite plastic. However, BN's disadvantages of high cost and low dispersity in resin restrict the feasibility to the application of composite plastic. In this study, we used natural sericite mica powder (KF-2000) and the sericite mica/ BN composite powders (CB-560, CB-680, and CB-890) to be the fillers of thermal insulating plastic. The investigated powders reduced the material cost significantly and improved the powder dispersity in resin. The thermal properties of composite plastic have been proven much better than the neat Nylon-66 plastic with 2~3 folds thermal conductivity, 3~5 folds thermal diffusivity and just ~1/2 folds heat capacity.

Key words: sericite mica, boron nitride, plastic composite, thermally conductive plastic, thermal management.

一、前 言

隨著科技進步，電子產品之電路複雜度及效能快速提升；但電子產品體積卻不斷的縮小，此現象使得導熱封裝材料之需求則日益增加。為了兼顧塑膠封裝材料的絕緣性及導熱性，很多文獻 (Wong and Bollampally 1999; Hill and Supancic 2002; Huang et al., 2011) 提出利用陶瓷粉末作為塑料填充材與塑膠混料，作成複合式工程導熱塑料。

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