

导热材料的研究现状及发展

摘 要

拥有良好的耐腐蚀性、易加工成型和质轻等优点的高分子复合材料在电气电子、航空等领域广受青睐。通过熔融共混的方式，填充性能优异的导热填料可以提高高分子材料的热导率。氮化硼(BN)具有优异的导热性和高的耐热性，本文通过机械剥离的方式，球磨改性氮化硼制备出六方氮化硼纳米片。以聚丙烯(PP)为基体，然后加入利用硅烷偶联剂(KH550)表面改性后的六方氮化硼纳米片(BNNS)为填料利用双螺杆挤出机、注塑机等设备制备出高导热复合材料。最后测试复合材料的硬度、冲击强度、拉伸强度、导热系数等。研究氮化硼纳米片(BNNS)填料量对于复合材料力学性能、导热性能的影响。结果表明 BN 材料的加入有效的提升了复合材料的热导率，在 BN 材料的质量分数为 15%时复合材料的热导率为 $4.7\text{K}/(\text{m} \cdot \text{k})$ 。但是高 BN 材料填充量的加入降低了材料的力学性能，尤其是复合材料的韧性。

关键词：聚丙烯；氮化硼；导热性能；导热复合材料

Abstract

Polymer composite materials with good corrosion resistance, easy processing and light weight are widely favored in the fields of electrical electronics, aviation and other fields. By means of melt blending, the thermal conductivity of polymer materials can be improved by the thermal conductive fillers with excellent filling properties. Boron nitride (BN) has excellent thermal conductivity and high heat resistance. In this paper, hexagonal BN Nano films were prepared by ball milling modified BN by mechanical stripping. The high thermal conductivity composite was prepared by using polypropylene (PP) as matrix, adding hexagonal boron nitride Nano sheet (banns) modified by silage coupling agent (KH550) as filler, using twin-screw extruder, injection molding machine and other equipment. Finally, the hardness, impact strength, tensile strength and thermal conductivity of the composite were tested. The effect of the amount of BN filler on the mechanical properties and thermal conductivity of the composite was studied. The results show that the addition of BN material can effectively improve the thermal conductivity of the composite. When the mass fraction of BN material is 15%, the thermal conductivity of the composite is $4.7\text{K} / (\text{m} \cdot \text{K})$. However, the mechanical properties of the composites, especially the toughness of the composites, are reduced by the addition of high BN content.

Key Words: Polypropylene; Boron nitride; Thermal conductivity; Thermal conductive composite

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