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Wetting mechanism of AgCuTi on heterogeneous surface of Diamond/Cu composites

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Abstract

The wetting mechanism of AgCuTi reactive alloy on copper, diamond films and Diamond/Cu composites surfaces is investigated. It is found that the AgCuTi/Cu and AgCuTi/Diamond wetting systems belong to dissolutive wetting and compound forming systems, respectively. The coexistence and interaction of dissolutive wetting and compounding forming wetting in AgCuTi/composites system play a crucial role in the wetting behavior, including the spreading time, wetting kinetics, driving force, final contact angle (θ_f), and final configuration of triple line. The initial wetting stage on composites surface is mainly controlled by the non-reactive wetting and dissolutive wetting, and the later stage is governed by the diffusion-limited compound forming wetting. The spreading of AgCuTi alloy on composites surface proceeds in the way that it spreads on Cu phase and diamond phase alternately. Wetting on composites surface exhibits the highest θ_f and medium length of spreading time among the three substrates. The θ_f of AgCuTi alloy on Diamond/Cu composites surfaces increases with the increase of diamond volume fraction.

Keywords: reactive wetting; heterogeneous surface; wetting kinetic; driving force; Diamond/Cu composites.

1. Introduction

Thermal aspect becomes increasingly important for the reliability of electronic components owing to the continuous progress of the electronics industry. Therefore, effective thermal management is a key issue for packaging of high performance semiconductors [1]. Metal matrix composites (MMC) offer the possibility of tailoring the properties of a metal by adding an appropriate reinforcement phase to meet the