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## 界面金属间化合物对铜基Sn-3.0Ag-0.5Cu焊点拉伸断裂性能的影响

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**摘要:**研究了Cu/Sn-3.0Ag-0.5Cu/Cu焊点在(150±1)°C时效温度下, 0-1 000 h不同时间时效后焊点的拉伸断裂性能以及界面金属间化合物(IMC)的组织形态和成分。结果表明:随着时效时间的延长,焊点拉伸强度降低,拉伸断裂主要发生于Solder/IMC界面或/和IMC/IMC界面,而且断口形貌逐渐由韧窝状断口为主向解理型脆性断口转变。SEM研究发现,时效过程中界面IMC不断长大、增厚并呈针状或块状从Cu/Solder界面向焊点心部生长,时效1 000 h的焊点中IMC分层明显。半焊点结构为Cu/Cu<sub>3</sub>Sn/Cu<sub>6</sub>Sn<sub>5</sub>/Solder,同时,在靠近铜基体的IMC中有Kirkendall空洞存在。

**关键字:** 金属间化合物; Cu/Sn-3.0Ag-0.5Cu/Cu焊点; 拉伸断裂; 多层结构; 柯肯达尔洞

## Effects of interfacial IMC on tensile fracture behavior of Sn-3.0Ag-0.5Cu solder joints on copper substrates

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**Abstract:** The tensile fracture behavior and the intermetallic compound's (IMC's) morphology and composition at the interface of Cu/Sn-3.0Ag-0.5Cu/Cu solder joint specimens after aging at (150±1)°C for 0-1 000 h were studied. The results show that, with the increasing aging time, the tensile fracture strength of the solder joints decreases and the crack initiates mostly at the interfaces between the solder and IMC layer or/and IMC and IMC layer. The morphology of fracture surface changes from dimple-like to cleavage-like surfaces. SEM analysis indicates that the needle-like or block-like interfacial IMC forms at the interface of Cu/solder and grows into the solder matrix. After being aged for 1 000 h, the obvious IMC multilayer structure is observed, which is defined as Cu/Cu<sub>3</sub>Sn/Cu<sub>6</sub>Sn<sub>5</sub>/solder structure for the half-joints. Moreover, the Kirkendall voids can be observed in the multilayer structure close to the copper substrate. These voids are possibly one of

the factors of the tensile fracture mechanism.

**Key words:** intermetallic compound (IMC); Cu/Sn-3.0Ag-0.5Cu/Cu joint; tensile fracture; multilayer structure; Kirkendall void

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