URN etd-0407109-183707-526
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Statistics This thesis had been viewed 40 times. Download 15 times.
Department
Year 2006
Semester 1
Degree Master
Type of Document Master's Thesis
Language zh-TW.Big5 Chinese
Title Investigations on thermal property, wettability and microstructure of the Sn-Zn-Ag-xAl-y(Bi/In)lead-free alloys
Date of Defense 0000-00-00
Page Count 102

Keyword
wettability
microstructure
lead-free solders

Abstract
The wettability, thermal property, and microstructure of the Sn-8.55Zn-0.5Ag- xAl-y(Bi/In) lead-free alloys (Al = 0.01 ~ 0.1 wt.%, Bi = 7.5 ~ 20 wt.% and In = 1 ~ 7.5wt.%) were investigated. The wetting behaviors between the Sn-8.55Zn-0.5Ag- xAl-y(Bi/In) alloys and Cu substrate have been investigated with the wetting balance method. The wetting time of the Sn-8.55Zn-0.5Ag-xAl-yBi alloys with Cu substrate is around 0.42 to 0.66 seconds, and the wetting force is within 0.69 to 1.14 mN. Additionally, the wetting time of the Sn-8.55Zn-0.5Ag-xAl-yIn alloys with Cu substrate is around 0.54 to 0.7 seconds, and the wetting force is within 0.89 to 1.38 mN. The wetting experimental results showed that the Sn-Zn-0.5Ag-0.1Al-(1~7.5)In and Sn-Zn-0.5Ag-0.1Al-(10~15)Bi alloys have a good wettability.
For Microstructure analysis, the Sn-8.55Zn-0.5Ag-xAl-yBi alloys consist of AgZn3 compound, Zn-rich phase, Bi-rich, and Sn-Zn hypo-eutectic phase. And the addition of In to the Sn-8.55Zn-0.5Ag-xAl alloy which consisted of Ag-Zn compounds, Zn-rich phase, InSn4 compound and Sn-Zn hypo-eutectic phase.
The results of DSC analysis indicate that the Sn-Zn-0.5Ag-xAl-yBi alloys exhibit the solidus-liquidus coexisting range increases from 4.6 to 13 °C with increasing of Bi content. The solidus temperatures of these alloys are within 165.4 to 187.3 °C, while the liquidus temperatures are within 178.2 to 191.9 °C. Next, the Sn-8.55Zn-0.5Ag- xAl-yIn alloys which solidus-liquidus coexisting range increases from 1.6 to 6 °C with increasing of In content. The solidus temperatures of these alloys are within 182.3 to 195.4 °C, while the liquidus temperatures are within 188.3 to 201 °C.
Advisory Committee T.Y. Kuo - advisor

S.C. Cheng - advisor

Files etd-0407109-183707-526-001.pdf

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Date of Submission 2007-08-14