

Phase transformation of the  $\text{Cu}_6\text{Sn}_5$   
intermetallic compound at the  
Sn-9Zn-xAg/Cu interface during  
solid-state reaction

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#### Abstract

A monoclinic to hexagonal phase transformation of the  $\text{Cu}_6\text{Sn}_5$  intermetallic compound at the Sn-9Zn-xAg lead-free solder/Cu interface has been investigated by X-ray diffraction (XRD), scanning electron microscope (SEM), energy dispersive spectrometer (EDS), transmission electron microscope (TEM) and electron diffraction (ED). The XRD and ED patterns show that the monoclinic  $\eta'$ - $\text{Cu}_6\text{Sn}_5$  and hexagonal  $\eta$ - $\text{Cu}_6\text{Sn}_5$  layer forms at the Sn-9Zn-xAg/Cu interface because Ag dissolves in the  $\text{Cu}_6\text{Sn}_5$  layer in soldering process. During solid-state reaction, Ag is repelled from  $\eta'$ - $\text{Cu}_6\text{Sn}_5$  and forms  $\text{Ag}_3\text{Sn}$  layer with Sn. The

monoclinic  $\eta'$ - $\text{Cu}_6\text{Sn}_5$  transforms to the hexagonal  $\eta$ - $\text{Cu}_6\text{Sn}_5$ .

Keywords: phase transformation, intermetallic compound, lead-free solder, solid-state aging, repel.