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In-situ X-ray imaging of transient liquid phase (TLP) bonding in solder joints

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The demand for Pb-free solder interconnections that can operate reliably at high service temperatures has motivated the development of transient liquid phase (TLP) bonding as an alternative soldering method. The capability of TLP bonding to be processed at a lower temperature while creating a joint composed of high melting temperature intermetallic compounds (IMCs) makes it a promising method. Sn/Cu-based systems are commonly used in electronic packaging due to their low melting point and cost benefits. However, the slow kinetics of the IMC growth and uncontrolled formation of porosity in Sn/Cu-based systems remain challenging issues in practical applications. The addition of Ni to the Cu substrate can minimize the time required for TLP bonding. In this study, the rapid growth of (Cu,Ni)₆Sn₅ during TLP bonding of Cu-Ni/Sn-0.7Cu/Cu-Ni joints was observed in real-time using the synchrotron X-ray microradiography technique at BL20XU beamline at SPring-8 Synchrotron, Japan. The joints were constructed to be approximately 100 μ m thick to facilitate X-ray transmission and clamped in between silica slides to facilitate X-ray transmission and held isothermally at 240 $^{\circ}$ C bonding until the reaction was completed. The formation of voids and cracks and the kinetics of the TLP soldering process were investigated using a monochromatised X-ray energy of 21 keV. These firsthand observations contributed to a better understanding of the creation and distribution of porosity, which will aid in the development of high reliability TLP bonding techniques for the production of high-temperature interconnections.

Presenter Gender

Woman

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

Students Only - Are you interested in AINSE student funding

Yes

Level of Expertise

Student

Pronouns

She/Her

Which facility did you use for your research

None of the above

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