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Mechanical property of nano porous sintered silver: Toward reliability estimation

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Sintered silver as a die attach material has attracted much research attensiton especially in the power electronics field, owing to its high heat dissipation capability. Many electrical systems comprises many die-attach parts electrically connecting semiconductor dies, and the coefficient of thermal expantion (CTE) of these parts differs variously. This inevtibaly leads to repeated mechanical stresses under heat cycle environments, deteriorating the die-attach materials. Thus the mechanical property of sintered silver plays a critical role to estimate the reliability of systems.

In this regard, the porosity inevitably embedded in sinterd silver is an important research issue. Other studies performed tensile tests with thick sintered silver films (over 100µm thick), however the thickness is much larger than that of die-attach layer thickness (~50µm). Thus, we cannot eliminate the possibility of differnt failure mode observation, and/or of underestimating overly the role of porosity. In this study, the authers prepare sintered silver films and bulk silver thin films with thickness of approximately 8-10 µm to focus on how the size of the pores therein affects the mechanical property of the films. The sintered films are fabricated from 5MPa to 60MPa pressure by using silver nanoparticles. The porosity (p) of the films ranges from 5% to 25%. This p is determined by scanning electron microscopy cross-sectional images of the films. For the sintered films, the stress-strain behaviors show no conventional ductile plateau disappears, and the breaking strain, and ultimate tensile strength negatively correlates with p. The tensile fatigue test is performed for the sintered silver with p=5% and the bulk silver. The fatigue lifetime of the silver films is shorter than that of the bulk silver one. The breaking point is larger for the sintered film, but the fatigue lifetime does not reflect this property, determined by the porosity.

Speaker Biography

Keisuke Wakamoto has completed his Master degree at the age of 25 years from Kyoto University, Japan. He is the research engineer of Rohm company Modules R &D group, Japan. His publication was published on May 21 from Japanese Journal of Applied physics 58, SDDL08 (2019).

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