

Ultrasonic Bonding of Annealing Twinned Ag-alloy Ribbons with DBC Substrates for High Power IC Packaging

Chun-Hao Chen^{1*}, Tung-Han Chuang^{1*}, S W Hsu¹, C Y Lin¹, H M Chang¹, Y C Lin², C H Tsai² and H H Tsai²

¹Institute of Materials Science and Engineering, National Taiwan University, Taiwan

²Wire Technology Co., LTD, Taiwan

Although aluminum thick wires and ribbons have been used for the interconnections between power IC chips and direct bonded copper (DBC) substrates, their low melting temperature limits the application in high power IC packages. Copper ribbon bonding was considered as an alternative material for aluminum wire and ribbon due to its high melting point and low electrical resistivity. However, the hardness of copper can cause damage to the metallization on IC chips and DBC substrates. In addition, the Cu ribbon tail at the stitch bond can be pulled up and detached. The ultrasonic bonding of Ag-alloy ribbon on DBC substrates metalized with Ni/Pd and Ni/Pd/Au films was evaluated for substitution of Al and Cu ribbons. The microstructure of such Ag-alloy ribbons has an ultra-high twin density of over 65%, which improves their mechanical strength without degrading the electrical conductivity. The results indicated that sound interfaces with satisfactory bonding forces of 1483 g and 1243 g can be obtained for the bonding of 100 μm thick pure Ag and Ag-4Pd ribbons on Ni/Au metalized DBC substrates, respectively. The bonding of Ag-4Pd alloy ribbons with thicknesses of 80 and 100 μm on the DBC substrates metalized with Ni/Pd and Ni/Pd/Au also showed sufficient pull strengths of 1283 g and 1247 g, respectively.

Biography:

Chun-Hao Chen received a B.S. degree in Department of Material Science and Engineering from National Cheng Kung University, Tainan, Taiwan, in 2013 and a M.S. degree from the National Taiwan University, Taipei, Taiwan, in 2015. He is pursuing a Ph.D. degree at the Institute of Materials Science and Engineering, National Taiwan University, Taipei, Taiwan. He has published 3 SCI papers on Ag-alloy electronic bonding wire. His research interests include IC bonding wire, electronic packages, and IC processes.