

Eliminated Nanotwinned Copper Bonding Interfaces Through Epoxy-Induced Fine Grains on Copper Surface

Tsan-Feng Lu(呂璨峰), Pei-Wen Wang(王佩玟), Yuan-Fu Cheng(鄭源甫), Yu-Ting Yen(顏郁庭),
Hsuan Hsiao Liu (劉宣孝) and YewChung Sermon Wu(吳耀銓) *

Department of Materials Science and Engineering, National Yang Ming Chiao Tung University, Hsinchu, Taiwan
sermonwu@nycu.edu.tw

Abstract

In recent years, Moore's Law has been approaching its limits. A promising way to replace Moore's law lies in three-dimensional integrated circuits, where Cu–Cu bonding plays a critical role. In this study, a novel method of surface modification using epoxy resin to form fine grains on a nanotwinned Cu film was invented. When bonded at 250 °C, the interfacial grains grew significantly into both sides of the Cu. When bonded at 300 °C, the interfacial grains extended extensively, eliminating the original bonding interface.

Keywords - Cu–Cu direct bonding; surface modification; grain refinement; abnormal grain growth; nanotwinned Cu