P-16: Through Hole Plating of Printed Circuit Boards using Ultrasonically Dispersed Copper Nanoparticles

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The work detailed herein was carried out to investigate whether copper nanoparticles could be utilized for two types of through hole plating in printed circuit boards (PCB) namely: (i) as a catalytic material to initiate the electroless copper deposition process and (ii) as a 'conductive' layer which is coherent and conductive enough to allow 'direct' electroplating of the through hole.

The study utilized drilled PCBs to evaluate the processes. The through holes were first functionalized before being immersed in a solution of copper nanoparticles which were dispersed using either a magnetic stirrer or ultrasound (40 kHz). When the copper nanoparticles were utilized as a catalytic material for electroless copper plating the efficacy of the technique was determined by assessing the degree of coverage of the electroless copper plating in the PCB through hole. As a control a standard palladium catalysed electroless copper process was employed. The morphology of the electroless copper deposit obtained by each process was also analysed using scanning electron microscopy.

In the 'direct plate' approach, after immersion in the copper nanoparticle dispersion, the through holes were electroplated at 3 Adm^{-2} for 15 minutes, sectioned and examined using an optical microscope. The distance that the copper electroplate had penetrated down the through hole was then determined.

It was found that the copper nanoparticles can be used as a catalytic material for electroless copper plating. The coverage of the electroless copper in the through hole was improved as the copper nanoparticle concentration was increased and, at the highest copper nanoparticle concentrations employed good, but not complete, electroless copper coverage was obtained. Dispersion of the copper nanoparticles using ultrasound was critical to the process.

Ultrasonically dispersed copper nanoparticles achieved some limited success as a conductive layer for 'direct' electroplating with some penetration of the electroplated deposit into the through hole. However if mechanical agitation was employed to mix the nanoparticles no through hole plating was obtained.

Reference

Through hole plating of printed circuit boards using ultrasonically dispersed copper nanoparticles Cobley A J, Comeskey D J, Paniwnyk L, Mason T J, Circuit World, 2010, 36(3), 9-13

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