

„CAMELOT“ Breakthrough in Printed Circuit Board and Multilayer Boards Technology !

Krefeld- The drilling correction of the inner-layer alignment is still the greatest quality risk in the production of multi-layers. Until now, in order to maintain an acceptable reject rate, many extremely machine-intensive work steps have been necessary (e.g. the use of x-ray machines). Thanks to a revolutionary technique developed in cooperation with the Lenz Company and the Fraunhofer Institute, for which a patent has been applied, we have managed to eliminate the quality pitfalls as well as to combine all of the work steps, from stock recognition to CNC drilling into one step. The advantages for cost and competitiveness are immense !

The Problem

Multi-layer pressing can only guarantee the best innerlayer adhesion if the fibre glass mats soaked in epoxide resin (prepregs), positioned between the innerlayers as a dielektric medium, gel. As a result of the high pressures (150 bar) and temperatures (175 C) applied the resin becomes so fluid that the inner-layers actually swim and expand due to the heat. This can result in undefined dimension instabilities as well as inner-layer alignment. It is extremely difficult to investigate the layer alignment as it is concealed by the unfinished outer copper foil and prepregs. The results are extreme drill alignments and, in extreme cases, fractured edges.

Conventional Solution Attempts

The most widespread process is the „approximate feeling,, of targets and their milling by means of a special milling machine. With a precision punch and the help of these targets, drill markings are punched on to the drilling machines to position of the Panel. The Panel still have to

be bordered and are attached drilling maching for CNC drilling at the end.

The use of x-ray machines to investigate the inner layers produces better quality but is extremely expensive. The expensive handling of products resulting from several machine changes, as well as the high investment costs prevent rapid and cost-effective multilayer production.

Searching for new solutions.

As relatively young multilayer producers, we hoped to avoid this well-worn but arduous path by attempting a completely new approach. The execution of all production steps at one bench, plus improved quality of CNC drill results was the goal we set ourselves. The basic idea was to adapt elementary information through a sensory system with the existing CNC tools and to process this further to achieve the best possible drilling procedure. It soon became obvious that the solution to such a complex task required the inter-disciplinary linking of CNC technology skills provided by the Lenz Company, the

Fraunhofer Institute's optoelectronic know-how, as well as our production experience.

The Revolution.

To end the suspense, the core procedure is a fundamentally ingenious idea, whereby a 15 mm line is added to all four corners of the layoput of each individual Multilayer Panel. Should movements between the layers occur during the pressing process, the difference in alignment is so minimal that it is barely perceivable. If the ML-Panel are applied on a CAMELOT processing station, the corners are exposed by an oblique section and measured by means of a high resolution image analysis system. From this information, the computer creates a three-dimensional map of the circuit structure image concealed beneath the copper foil. This data enables

either the best possible positioning of pinning holes for further processing on other CNC machines, or the layers of each individual multi layer can be aligned and operated with the local CNC routine. Boring takes place at the same time to remove the copper and epoxide projections from the edges of the Panel and to achieve its specified dimensions. Of course the layer recognition routine takes longer than a conventional CNC procedure, but it is not presumptuous to claim that immediately after pressing the multi layer has the quality of a plated through circuit

The art of viewing chicken eggs clearly.

Although the fundamental idea appears ingeniously simple, the most sophisticated German technology was necessary to carry it out. It was extremely complicated to develop a camera system which can not only see all spatial levels equally clearly, but is also able to see the lines located at different distances, and to measure them. (To give some idea of the difficulty, one could compare viewing a boiled egg from above and trying to see the egg cup as well as the tip of the egg clearly). The Fraunhofer Institute's achievements in the

development of highly intelligent camera systems was of invaluable help.

Summary

After completing an extended trial run to confirm the production capability of the entire system, we at Microcirtec now have a tool at our disposal that, at present, is unique in the world of printed circuit boards. It enables something that is often impossible – namely, enormous savings (by means of greatly reduced handling, as well as lower investment costs), plus a far higher processing quality. These are a lot of reasons to work with us.

Allignment recognition by milling out the buried target on the different layers and calculate the proper offset.

