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# FABRICATION OF FLEXIBLE HIGH-DENSITY MULTI-LAYER SUBSTRATES

Flexible Multi-Layer Substrate with High Density Copper Wiring

There are a variety of electronic systems which need flexible substrates for component as well as next level system interconnection purposes. Considering the corresponding application scenario, the flexible substrates have to support different complexities regarding number of routing layers, intra-layer routing density and type of interconnect metallization.

Fraunhofer IZM offers a versatile process for the manufacturing of high density multi-layer flex substrates. The fabrication approach features the capabilities of Fraunhofer IZMs well established wafer level redistribution technology which is applied on rigid temporary carrier wafers. High density wiring structures are generated in semi-additive technology using seed layer deposition by PVD, mask aligner technology for pattern definition as well as electro-chemical deposition of metals and wet-chemical differential etching. Typically copper is used as wiring metallization with up to 5 µm track height and line pitches below 15 µm. Inter-dielectric layers with micro vias are fabricated by spin coating, lithographic structuring and cure of photo sensitive polyimide precursors. A multi-layer build-up is obatined by sequential alternated processing of polyimide and metal layers.
With the current technology, flexible substrates with up to four internal metal routing layers were fabricated so far. The proposed technology also allows the realization of electrical contacts through the flex substrates. With that option, interconnections from the bottom to the top side of the flex substrates are possible.
As further feature, customer-specific pad metallizations like Cu, CuSn, Au, NiAu, AuSn or AgSn can be fabricated to accommodate the flex substrate to the desired assembly and interconnection processes such as soldering, wire bonding or thermo compression bonding using conductive adhesives. Based on standard redistibution technology, additional features like integrated passive components such as inductors, capacitors and resistors can be implemented into the multi-layer wiring structure of the flex substrates.
After the processing of the multi-layer build-up is fully finished, it will be detached from the temporary carrier wafer using a specially designed high-speed debonding process. During that process an interface layer between the carrier wafer and the bottom layer of the flex substrate is opened so that the flex multi-layer can be peeled off.

By using the described technology, fully customer-specific foldable or stackable flexible multi-layer substrates with arbitrary shapes and forms as well as chemical and high temperature stability can be manufactured.

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