Laser direct structuring of three-dimensional Pocan® interconnect devices

A significant current trend in industrial production of electric and electronic devices involves the miniaturization of the individual components, whilst simultaneously equipping them with greater functionality. A successful solution lies in using three-dimensional injection molded plastic interconnect devices (3D-Molded Interconnect Devices or 3D-MID in short). Not only do they offer a high level of design freedom, but they can even be used to create sophisticated mechatronic systems that combine electric and mechanical functions.

The LPKF Laser & Electronics AG's laser direct structuring process is an innovative technology used to manufacture 3D-MIDs. It allows conductive tracks and electronic components to be attached directly to the plastic interconnect device in a simple, environmentally friendly process (without the use of etching or caustic chemicals). The process offers an extremely high level of layout flexibility. Moreover, it was recently shown that the miniaturization potential of the process has still not even come close to being exhausted. In contrast, conventional processes are already reaching their limits in this respect with many electronic components.

The LDS process is based on thermoplastics containing a certain complex organometallic compound as the active additive. Three-dimensional molded parts are made from these thermoplastics, and a laser then 'writes' a high-definition circuit diagram on their surface. In this process the laser beam vaporizes the topmost layer of polymer and activates the underlying metallization nuclei of the active additive. The activated areas are then plated with a layer of copper in an electroless metallizing bath, and electro-reinforced if necessary.

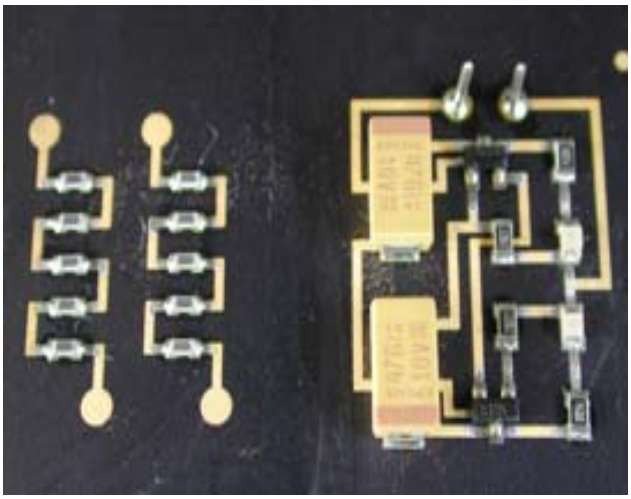
Customized polyesters

LANXESS has developed various grades of its Pocan® polyester for laser direct structuring. They are adapted so that all the process steps can be easily managed, from the preparation of materials to the finished component (injection molding, lasering, metallizing, and soldering if necessary).

Pocan® DP 7102 is a PBT designed for injection molding, with a 25 % mineral content. It allows the production of warpage-free molded parts with excellent surface quality. We also offer **Pocan® TP 710-003**, which can be used to extrude profiles that can then be further developed into interconnect devices using the LDS process.

Pocan® DP T 7140 LDS for lead-free soldering

Pocan® DP T 7140 LDS has a glass fiber / mineral content of 40 % and is heat resistant at very high temperatures. It is suited to lead-based and particularly to lead-free soldering processes using SnAg(Cu) alloys. It can stand up to the temperatures of both vapor phase soldering (approx. 230 °C) and reflow soldering (furnace temperatures up to 275 °C). Both these processes are very widely used in the manufacture of 3D-MIDs.



Pocan® for laser direct structuring

		DP 7102	DP T 7140 LDS	TP 710-003
		PBT MD25	PET/PBT (GF+MD)40	PBT MD25
		Injection molding		Extrusion
Melting temperature	°C	225	255	225
HDT method Bf (0,45 MPa)	°C	190	250	190
MVR (260 °C / 2,16 kg)	cm³/10 min	10	21 (280 °C)	5
Stress at break	MPa	55	100	61
Strain at break	%	2	1,1	3,3
Flexural modulus	MPa	5600	12000	5500
Izod impact strength 23 °C	kJ/m²	25	25	40
Izod notched impact strength 23 °C	kJ/m²	< 10	< 10	< 10
Molding shrinkage (parallel / across)	%	1,3 / 1,3	0,21 / 1,04	1,4 / 1,4
Post-shrinkage (parallel / across)	%	0,3 / 0,3	0,07 / 0,19	0,3 / 0,3
CLTE (parallel / across)	10^{-4}/K	0,6 / 0,9	0,36 / 0,56	0,7 / 1,0
Density	kg/m³	1565	1750	1565
Adhesion	N/cm	12 - 14	8	12 - 14
Processing advice				
Drying conditions		4 h / 120 °C		
Melt temperature	°C	260 - 280	270 - 290	260 - 280
Mold temperature	°C	80 - 100	80 - 120	80 - 100

Data sheets for the mentioned Pocan grades and information regarding the LDS technology can be found on our Internet sites (TechCenter Semi-Crystalline Products - link see below).

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