Case Study

RFID transponder – three-dimensional antenna using LDS technology

Figure 1 RFID transponder

Material: Pocan® DP T 7140 LDS

Molder: Harting Mitronics AG, Switzerland

Industry: Electric/Electronics

In the retail trade and in the field of merchandise management as a whole, radio tags or RFID transponders (RFID = Radio Frequency Identification) are regarded as the technology of the future for simplifying and speeding up logistic processes. They are attached to containers, boxes and crates to provide information on, for example, their contents, condition, origin and destination.

With the aid of Laser Direct Structuring* (LDS), Harting Mitronics AG has succeeded in developing a new generation of transponders (Figure 1) with a much greater performance and range. Pocan® DP T 7140 LDS is used to manufacture the three-dimensional plastic carrier, also known as a molded interconnect device (MID)

The transponders contain a chip to store the data on the respective product. The information can be read in a fraction of a second or be overwritten with new data. For many applications in logistics and industry, the tags must be readable over a fairly long range, even when close to metals and liquids. So-called smart labels (plastic film-based RFID transponders) used until now are unsuitable for such applications. Through the use of Laser Direct Structuring (LPKF-LDS®) and the LANXESS plastic Pocan® DP T 7140 LDS (a blend of PET and PBT developed specifically for this technology), it has now become possible to produce RFID transponders that fully comply with these specifications. Through a three-dimensional directional antenna structure, a range of more than 5 m can be achieved (depending on the shape). Apart from that, the welded air- and water-tight housing is designed for extreme ambient conditions and to comply with IP 54 to IP 67 and IP69K (International Protection).

Figure 2 Transponder on skeleton transport box

Many new fields of application can be opened up with these RFID transponders:

- Logistics
- Tracking of manufactured goods
- Transport containers (Figure 2)
- Quality control
- Process control
- Spare parts management

An innovative technology:
Laser Direct Structuring

A thermoplastic modified with a special additive is used to manufacture the transponder. The part is produced by the conventional injection molding process, after which the three-dimensional antenna structure is lasered directly onto the part. During this operation, the metal complexes contained in the thermoplastic are activated by the laser energy. After this comes electroless metallization in various baths (copper, nickel, gold). The result is a component with a conductive pattern firmly anchored in the thermoplastic (Figure 3). The chip needed to store the data is welded directly onto these conductive tracks by wire bonding.

Laser Direct Structuring allows not only the production of three-dimensional conductive patterns, it also reduces the number of necessary parts, like a separate printed circuit board. For many applications, this opens up scope for new designs, enabling e.g. further miniaturization of components.

Figure 3 Three-dimensional antenna structure produced using LDS technology

Pocan® is noted for its excellent electrical and mechanical properties and is therefore a popular material for use in electrical and electronic components. Pocan® DP T 7140 LDS is suitable not only for the LDS process, but because of its high heat deflection temperature, it can also withstand the temperatures prevailing in lead-free reflow and vapor-phase soldering.

* The use of Laser Direct Structuring for the production of MID may be dependent on the protective rights of third parties, for example EP 1191127 B1, EP 1274288 und EP 0 917597 B1.

LPKF-LDS® is a registered trademark of LPKF Laser & Electronics AG

Pocan® is a registered trademark of LANXESS Deutschland GmbH

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Typical Properties
Property data is provided as general information only. Property values are approximate and are not part of the product specifications.

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Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling LANXESS products mentioned in this publication. Before working with these products, you must read and become familiar with the available information on their hazards, proper use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets (MSDS) and product labels. Consult your LANXESS Corporation representative or contact the Product Safety and Regulatory Affairs Department at LANXESS. For materials that are not LANXESS products, appropriate industrial hygiene and other safety precautions recommended by their manufacturer(s) must be followed.

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Some of the end uses of the products described in this brochure must comply with applicable regulations, such as the FDA, NSF, USDA and CPSC. If you have any questions on the regulatory status of any LANXESS engineering thermoplastic, consult your LANXESS Corporation representative or contact the LANXESS Regulatory Affairs Manager.

Regrind
Where end-use requirements permit, regrind may be used with virgin material in quantities specified in individual product information bulletins, provided that the material is kept free of contamination and is properly dried (see maximum permissible quantities and drying conditions in product information bulletins). Any regrind used must be generated from properly molded/extruded parts, sprues, runners, trimmings and/or film. All regrind used must be clean, uncontaminated, and thoroughly blended with virgin resin prior to drying and processing. Under no circumstances should degraded, discolored, or contaminated material be used for regrind. Materials of this type should be discarded. Improperly mixed and/or dried regrind may diminish the desired properties of a particular LANXESS product. It is critical that you test finished parts produced with any amount of regrind to ensure that your end-use performance requirements are fully met. Regulatory or testing organizations (e.g., UL) may have specific requirements limiting the allowable amount of regrind. Because third party regrind generally does not have a traceable heat history or offer any assurance that proper temperatures, conditions, and/or materials were used in processing, extreme caution must be exercised in buying and using regrind from third parties. The use of regrind material should be avoided entirely in those applications where resin properties equivalent to virgin material are required, including but not limited to color quality, impact strength, resin purity, and/or load-bearing performance.

Note:
The information contained in this publication is current as of August, 2008. Please contact LANXESS Corporation to determine if this publication has been revised.