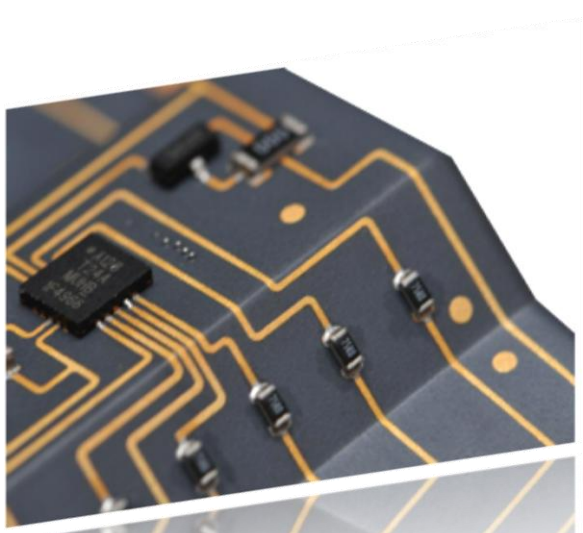
S2P
SMART PLASTIC PRODUCTS

When plastics meet electronics for smart plastic products



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S2P SMART PLASTIC PRODUCTS

An innovative technological context…

- **Smart Plastic Products**
  - A smart plastic product is a complex 3D plastic part that **interacts with its environment** through the integration of « smart » functions
  - These smart functions can be made by active material, or by the integration of **electronic components**.

- **3D-MID (Molded Interconnect Devices)** are made by selective plating technologies that enable to build in one sub-assembly :
  - The mechanical function
  - The electronic function
  - And the packaging function

...answering market needs

3D-MID benefits

- Functions integration / Miniaturization
- Design freedom
- Assembly simplification
- Weight reduction
- Process flexibility
- Technical and esthetic functions mixing
- **Global production cost optimization**

3D-MID functions

- Antennas
- Sensors
- LED Lighting
- Tracks, 3D PCB
- Battery holder
- Anti intrusion structures
- EM Shielding
- Connectors
- Local heating
- Decoration

Source: BMW,, Citec/Uni Bielefeld

S2P SMART PLASTIC PRODUCTS

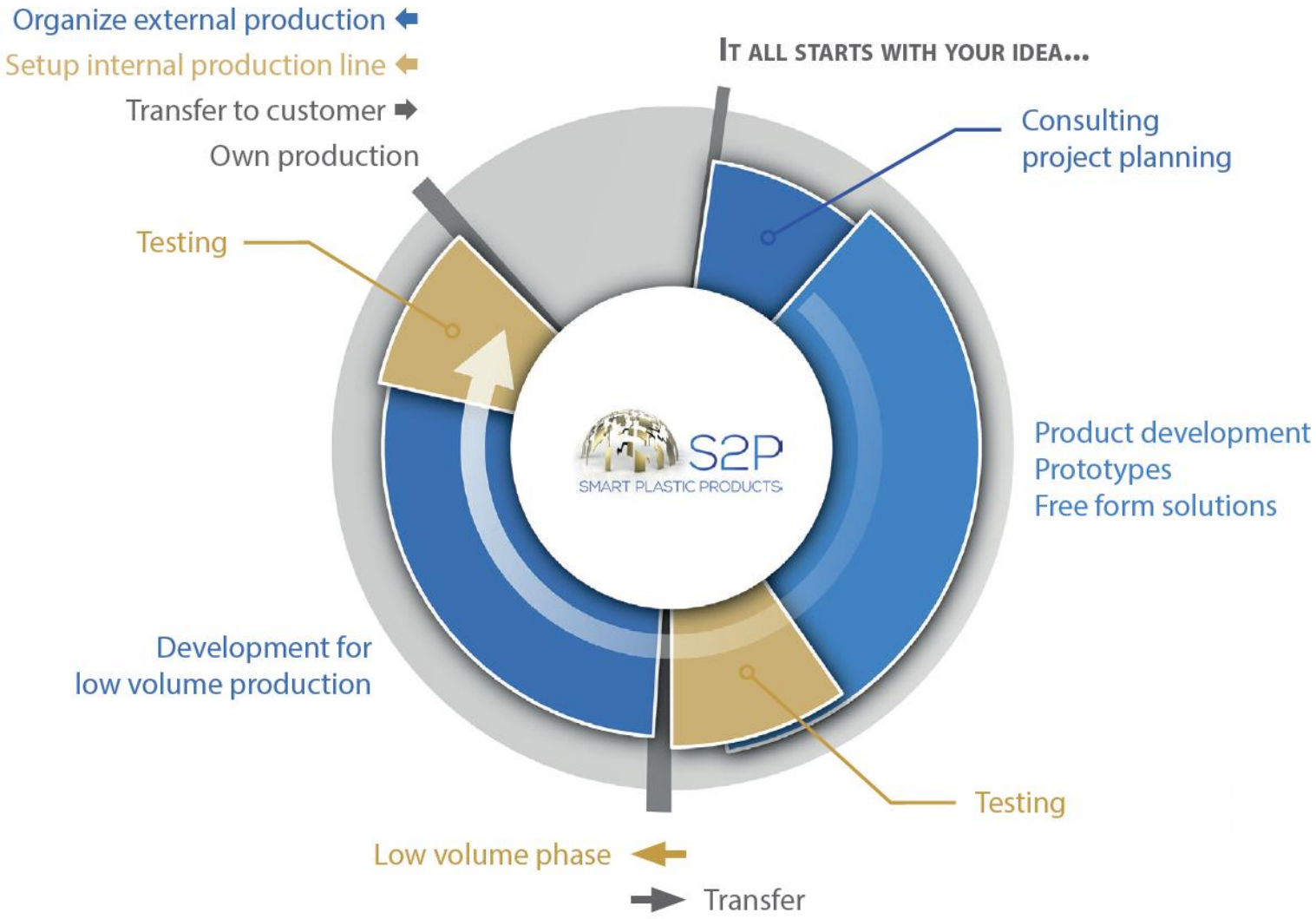
WHO ARE WE ?

From prototyping to series, on the full value chain.

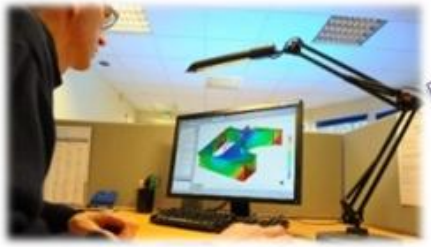
S2P in words

- **SME company located in Oyonnax-France,** in the heart of the Plastic-Valley
- Spin off of **PEP**, **the French technical center for plastics and composites**, after 10 years of R&D on 3D MID technologies.
- Specialized in services for **designing, prototyping and manufacturing** of smart plastic products.
- **A multidisciplinary team** of technicians, engineers and doctors in **mechanics/ plastics, chemicals** and **electronics.**
- **Our goal** is to give to the industry the possibility to:
  - Develop and manufacture these new products without having to invest heavily in the short term on the means and skills
  - Transfer technologies to partners whishing to invest
  - Benefit from a technological incubator through the development of emerging technologies in 3D-MID to manufacture the next generation of Smart Plastic Products

S2P in words : our services



S2P in words : our means



1.Product design

2. Plastic/composite substrate manufacturing

3. Selective activation

4. Plating

5. Component assembly

6. Quality control

Design to cost !
Optimal co-design of products integrating the full process flow

S2P KEY TECHNOLOGIES

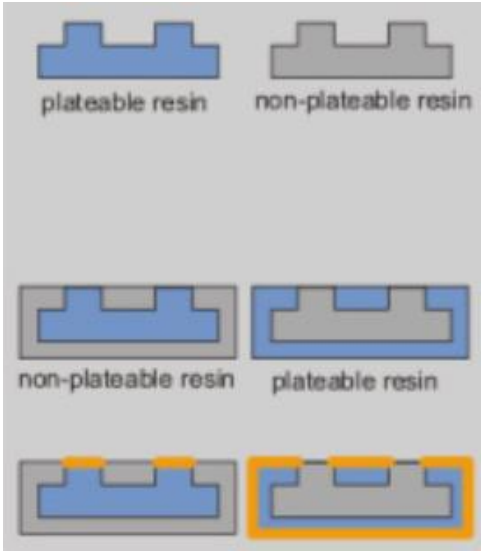
2-Shot Molding, Laser Direct Structuring, Plasmacoat 3D

2-Shot Molding

- 2-Shot molding (3D masking)
- Chemical surface activation
- Electroless Cu plating
- Surface finishing: Ni+Au / Ag

- Benefits :
  - Short process
  - Cost effective on high volumes

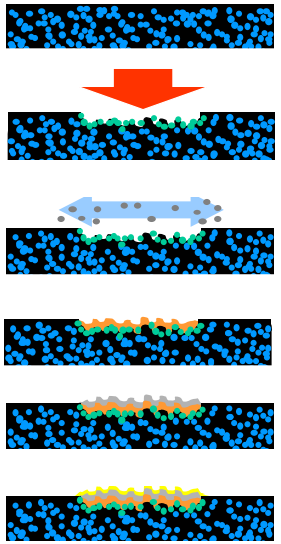
- Drawbacks :
  - 2-Shot tool investment
  - Low flexibility
  - Mainly signal applications
  - Few material available



Source: Bosch

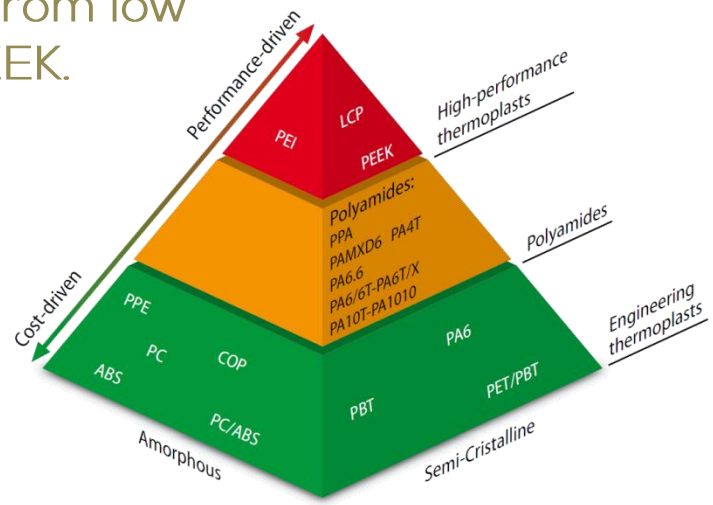
Laser Direct Structuring – LDS®

- Single material injection molding
- 3D laser activation
- Electroless Cu plating
- Surface finishing : Ni+Au / Ag / Sn



- Benefits :
  - High flexibility
  - From prototyping to very high volumes
  - More and more materials available: from low cost ABS up to high performance PEEK.

- Drawbacks :
  - Mainly signal applications



LDS® Smart Composites !

- LDS process can be used on thermosets !
  - Raschig GmbH: Epoxidur EP 3915, **epoxy resin** processable by Bulk Moulding Compound (BMC) injection.
  - **Other thermosets are under development**: phenolic, polyester

Laser Direct Structuring – LDS®

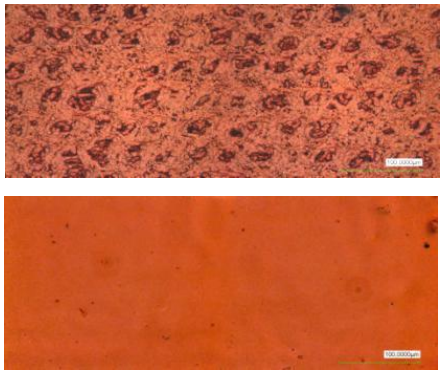
- Possibility to increase the copper layer by **galvanic plating** (electroplating)
  - up to 1µm/min: 65% time reduction compared to electroless-only
  - Decrease of roughness down to Ra=0,2µm

Example on PC-ABS Xantar LDS 3710

. E-less Cu : Rz=11,4µm; Ra=1,2µm

. Galv. Cu : **Rz=1,4µm; Ra=0,2µm**

Cu 35µm / NiP 4 µm / Au 0,1 µm

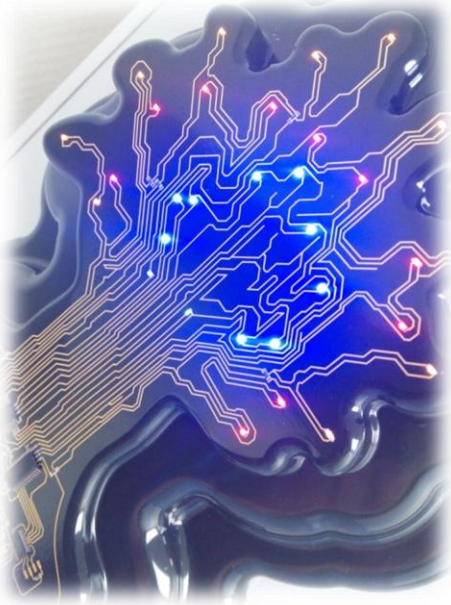


Source: LPKF

LDS® rapid prototyping

- **Several possibilities**
  - 3D machining of LDS polymer blocks
  - Use of an **innovative LDS lacker** (activable and platable) on parts made by machining, conventional injection moulding, or even **rapid prototyping tecnologies** (SLM, FDM, ...)
  - Conventional injection moulding in rapid prototyped thermoset moulds !

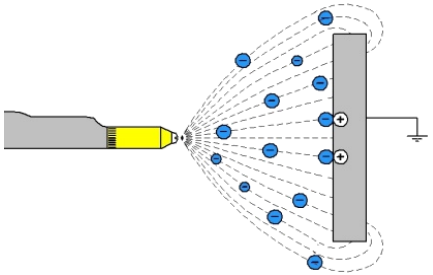
New

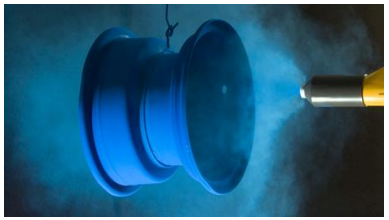


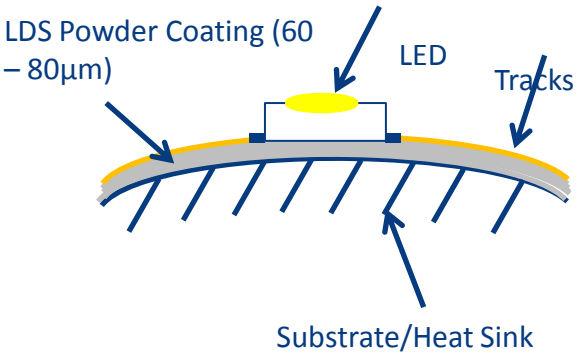
LDS® PowderCoating

Authorized LDS Manufacturer
LPKF Laser & Electronics

- Integration of electronics on 3D metal parts !
  - We apply a **powder lacquer** (dry PU or PES based) by electrostatic spraying on conductive materials
  - After curing, **standard LDS** steps are applied.
  - The coating is appropriate for **reflow soldering at 240/270°C**
  - Well suited **for thermal management !**







Source: MID-tronic, essemtec, LPKF, Zollner Elektronik AG

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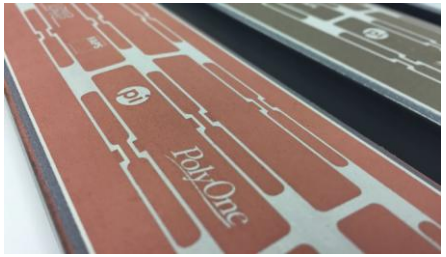
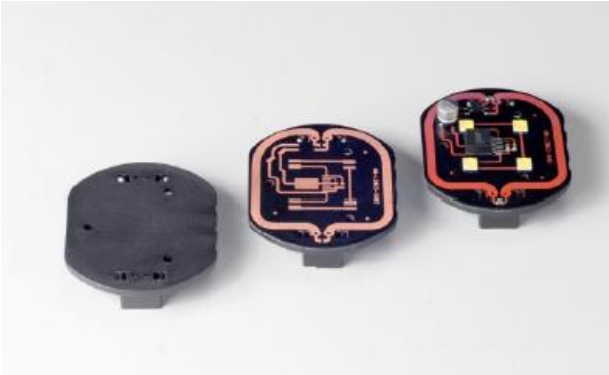
Plasmacoat 3D

- Polymer substrate or other
- 2D or 3D masking
- Plasma copper coating

- Benefits :
  - Dry metal deposition (integration in an existing production plant)
  - Important thickness possible for power applications
  - Possible on transparent materials



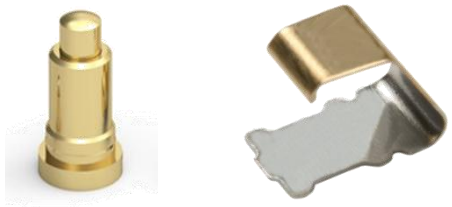
- Drawbacks:
  - Low complexity parts
  - Material validation needed for plasma parameters optimization



Source: Plama Innovation, LPKF, RF Plast, Polyone

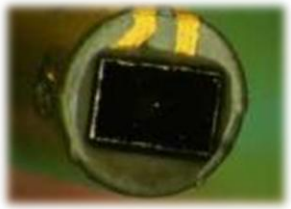
Assembly of 3D-MID

- **Mechanical interconnections**
  - Pogo pins, spring contacts, zebra contacts, press-fit, etc.
  - Use of the plastic part elasticity to make pressure contacts (on PCB, batteries, …)



- **Compatible with SMD assembly !**
  - Dispensing of up to lead-free solder pastes
  - Pick & place of electronic components
  - Standard 2D or specific 3D available
  - Reflow soldering, laser soldering

- **Chip assembly**
  - wire-bonding
  - flip-chip



- **Possibility to use 3D-MID as macro-components on PCB**

Source: Harwin, Haecker Automation, Bosch, Harting Mitronics

APPLICATIONS AND MARKETS

Telecommunication, automotive, industry, medical…

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SMART PLASTIC PRODUCTS

Telecommunication & connected objects

- First world market of 3D-MID
- **From DC to more than 10 Ghz,** perfect for antennas !
  NFC, UHF, GSM, 3G, 4G, Wifi, Bluetooth, LORA/Sigfox, etc
- Towards the integration of antennas directly on covers


iid G9









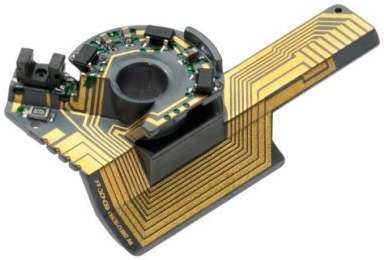


Source: Molex, TE, Samsung, Nexus, Sony

S2P SMART PLASTIC PRODUCTS

Automotive / transportation

- Interconnections modules
- Sensors
- Switchs
- Antennas
- LED Lighting



Module for adaptative cruise control in ARS 300
(Harting Mitronics for Continental, LCP LDS)

Rear Lighting(CRP Italie, PA LDS)

Steering wheel switches (BMW Z4 Roadster, PBT LDS)

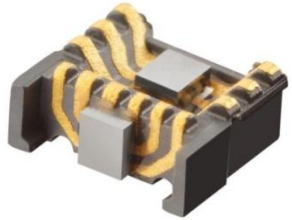
ESP pressure sensor (BOSCH, LCP bi-matière)

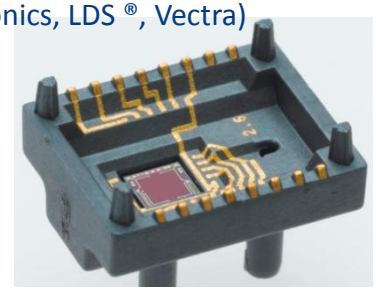
„Shark“ antenna(BMW, LCP LDS)

Industry

- Smart packaging
- Function integration
- LED
- Antennas (RFID)

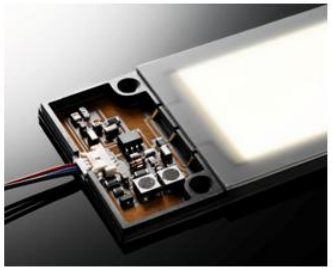
Sensor , designed for SMT mounting on PCB (HARTING Mitronics, LDS ®, Vectra)





Lighting System for Security Camera v300 ws (HARTING Mitronics for SICK, LCP LDS

OLED lighting by OSRAM



RFID transponder (HARTING Mitronics, LDS ®, Vectra)

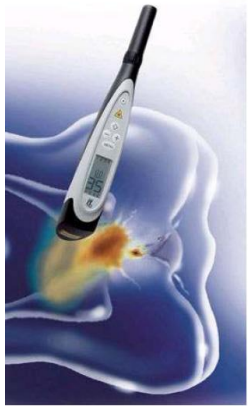
Bionic ant by Festo (LDS Prototaint)

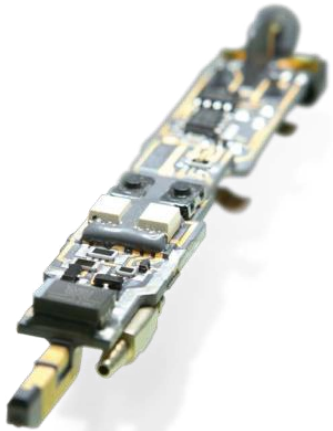
Medical

- 3D electronic circuitry
- Function integration
- Ergonomics

Microphone module for hearing aid (HARTING Mitronics for Siemens, LDS ® Vectra)

Switch element (HARTING Mitronics for KaVo Dental, LDS ®, Vectra)





3D-circuit-board for dental hand-piece (KaVo Dental Excellence, LDS®, Ultramid)

LED Carrier (2E mechatronic & Laser Micronics for KaVo Dental, LDS®, Vectra)

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