Laser Solutions for the Automotive Industry
Our presenters

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Creative Marketing Specialist

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Mini Q&A after each guest speaker, one large Q&A to wrap up
The Automotive Sector
About LPKF

Portland

Hannover

Laser Plastic Welding

Laser Structuring of 3D MIDs

UV Laser Depaneling

Rapid PCB Prototyping
Laser Welding of Tail Lights
How Does LPW Work?
Joint Types

Lap Joint

T Joint
Benefits of Laser Plastic Welding

• Clean and precise
• Aesthetics
• Process monitoring
• Integration
• Short cycle times
Plastics Compatibility

Common Automotive Plastics compatible with Laser Plastic Welding

- Nylon materials (PA6, PA6/6, PA12)
- POM
- PBT
- PC/ABS
- PE
Drivetrain and Fuel Components

Various sensor covers

Water level sensor (Black-black weld)
Drivetrain and Fuel Components

CV boot or CV gaiter
(Hard-soft weld)

Radial welded valve
Instrument Cluster Enclosure
Laser Plastic Welding Applications

Questions?

Drivetrain and Fuel System Components
Tail Lights
Instrument Cluster Enclosure
Laser Circuit Etching on Plastics
What is an MID?

<table>
<thead>
<tr>
<th>Circuit board</th>
<th>Housing</th>
<th>Connector</th>
<th>Cable</th>
</tr>
</thead>
</table>

[Diagram of a steering wheel with an MID inside]
The Laser Direct Structuring Process

1. Injection Molding
2. Laser Activation
3. Metallization
Laser Activation

Organic ligands

Metal atom

Metal seeds

Polymer + metal-organic complex

- Metal
- Nitrogen
- Oxygen
The Laser Direct Structuring Process

1. Injection Molding

2. Laser Activation

3. Metallization
Benefits of MIDs and LDS

**MID Benefits**

- Go from 2D to 3D
- Fewer components/parts
- Save space, reduce weight, lower cost

**LDS Benefits**

- Single-shot injection molding
- Create complex 3D circuitry
- High-resolution features
- R&D through large scale production
LDS Grade Materials

Common Automotive Plastics available in an LDS grade

- Nylon materials (PA6, PA6/6, PA6/6T, PA12, PPA)
- PC/ABS
- LCP
- PBT
Wiring Harness

- Streamlined wiring
- Makes use of 3D design space
Antennas

Photo courtesy of Molex
Motorcycle Handlebar
Questions?

User Interface

GPS, Bluetooth, and Cell Antennas

Motorcycle Handlebar

Wiring Harness
Stress-Free Processing of Optical Components
Depaneling Populated PCBs

- UV laser depaneling of populated PCBs
- Minimized debris - perfect for boards with sensitive optical components
Debris-Free Laser Depaneling

Routing

UV Laser
UV Laser Depaneling

- No mechanical stress
- Limited thermal stress
- Cut any PCB material
Limited Thermal Stress

125 µm polyimide (Kapton®)

- Cut on CO₂ system w/ 20 µm beam
- Charring results in 120 µm cut width

- Cut on UV system with 20 µm beam
- Reduced HAZ results in 30 µm cut width
Flex Circuits in Cars

- Under-Hood Controls
- Rear Window Defrost
- Antilock Breaks
- Powertrain Controls
- Fuel Pumps
Flex Circuits in Cars

- GPS Systems
- Air Bag Systems
- Starter/Alternator
- Electric Windows/Seats
- AC
Flex Circuits in Cars

Questions?
Rapid Prototyping of PCBs

- In-house mechanical milling or laser processing
- **Boards ready in under an hour**
- Vital for reducing time-to-market
Sub-Circuits for F1 Racing Teams

“Being able to test, verify, and modify sub-designs quickly while they are still in the design process gives our group the chance to focus on quality… No doubt, the LPKF system provides us with the leading edge on quality, as well as stability and performance.”
“The LPKF ProtoMat is small and easy to use. It is very useful to make all kinds of small-series PCBs. And it corresponds fast to design changes!”

- Tomokazu Wantanabe, DENSO
RF Sensors

- Rapid creation and fine tuning of RF sensor boards

[Image of RF sensor board]

[Los Angeles Times article about car-to-car communications]
# Rapid Prototyping of PCBs

<table>
<thead>
<tr>
<th>Mechanical Processing</th>
<th>Mechanical/Laser Processing (combined)</th>
<th>Laser Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applications:</strong> Test boards, sub-circuits</td>
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</tr>
<tr>
<td><strong>Materials:</strong> FR4, HF materials (Rogers)</td>
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<td><strong>Materials:</strong> FR4, HF materials (Rogers), <strong>fired ceramics, flex</strong></td>
</tr>
<tr>
<td>Min. trace/space: 4 mil/4 mil</td>
<td>Min. trace/space: 2 mil/1 mil</td>
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</tr>
<tr>
<td>Speed: ★</td>
<td>Speed: ★★★</td>
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Rapid Prototyping of PCBs

Questions?
Conclusion

**Laser Solutions for the Automotive Industry**

- Laser plastic welding of lighting and components
- Laser direct structuring of 3D MIDs
- Stress-free UV laser depaneling
- Rapid prototyping of PCBs
Poll

Which technology interests you most?

- Laser plastic welding
- 3D circuitry on plastics
- UV laser depaneling
- Rapid PCB prototyping
- None of them interest me :’( 
Thank you for your attention!
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Questions

Submit via your GoToWebinar questions panel or Twitter (@LPKF_USA)