Prof. Dr.-Ing. Jörg Franke
Lehrstuhl für Fertigungsaufomatisierung und Produktionssystematik
Friedrich-Alexander-Universität Erlangen-Nürnberg

Applicationcenter for Molded Interconnect Devices (MIDAZ)
MIDAZ supports development and prototype-manufacturing as well as production engineering for mechatronic integrated devices.

### Requirement
- Integration of functions
- Miniaturization
- High dependence
- Cost reduction

### Challenge
- Integrated electr./mechan. design
- Low practical experience
- Material variety
- Process chain complexity

Function-oriented conception of the product manufacturing-optimized design of the product

MIDAZ supports during the whole development

- Selection of qualified applications
- Development of mechatronic devices
- Manufacturing of functional prototypes
- Production engineering and simulation
- Dependence-analysis, Product-qualification
- Limited-lot production
The development of molded interconnect devices (3D-MID) requires special know-how and qualified tools.

- Analysis of existing and new products and product-technologies with special software-tools in order to analyze applications and economy
- Advice in possible optimizations of products alternatively new product ideas
- Function-oriented conception of the product:
  Integration of thermal, optical, liquid, mechanical and electrical functionality
- Integrated design of the mechanical and electrical design in 3D-ECAD
- Advice in material commitment, qualification of materials
- Design for Manufacturing with computer-aided simulation systems (particularly process-, kinematik-, discrete arrangement-simulation)
- Analysis in dependance
- Optical and destructive inspections
MIDAZ provides different technologies for the manufacturing of functional prototypes

- **Technologies for prototype manufacturing**
  - Stereolithography
  - Micro-cutting out of standard-LDS-materials
  - PU-moulding with silicon form for big lots
  - Rapid Tooling for lots bigger than 100

- **Structuring und metallization**
  - Hot embossing
  - Aerosol-Jetting (Optomoec)
  - Plasmastructuring (Rheinhausen Plasmadust)
  - Laserstructuring (LPKF-LDS® and ProtoPaint) and chemical metallization (e.g. Cu-Ni-Au)

- **Electronic-Mounting-Technologies**
  - Interconnection technologies with conductive adhesive and low-melting solder
  - Flexible manual mounting – also qualified for extremely small devices
  - Fully-automated 3D-Mounting for precision requirements
  - Adapted solder-technologie (e.g. vapor phase soldering or selective soldering methods)

- **Test- and dependance-Analyses**
  - Electrical function test
  - Dependance analysis (temperature cycling-, shock-, vibration-tests systems)
  - Optical and destructive inspections
The first step in structuring of 3-D-MID with LPKF-LDS® and ProtoPaint

- Advantages of LPKF-LDS®
  - Large variety of substrate materials with LDS-additive available
  - 1K-injection moulding possible
  - Easy data preparation of CAD-models with integrated software tools
  - Independent component adapters for completely 3D verification
  - ProtoPaint: LDS-varnish usable for common plastic materials
Electrical Structures using 3-dimensional printing - Aerosol-Jet

- Advantages of Aerosol-Jet
  - Fine structures (< 100 µm)
  - Printing of functional elements (conductor path, resistance)
  - Large variety of material properties of the ink
  - Complex 3D structures due to contactless printing method
  - No chemical metallization because of completely additive process
Innovative plastics coating method plasmadust®
using cold-active atmospheric plasma

- Advantages of plasmadust®
  - Low thermal stress of the substrate material (10 – 150 °C)
  - Variability of the substrate material (plastics, metals, glass, textiles)
  - Variability of the coating material (metals, semiconductor, plastics)
  - Flexible coating thickness (1 – 200 µm)
  - 3D-capability using a flexible manipulation system
The manufacturing of limited-lots is supported by qualified co-operation partners

- Process development for special challenges in manufacturing of 3D-MIDs
- Development of qualified processes for the whole process chain (construction of the interconnect device, structuring and metallization, 3D-Mounting)
- Systems engineering for the electronical production at FAPS
  - Stencil printer
  - Dispenser
  - Standard-SMD-Mounting machine
  - Automated 3D-Mounting technology
  - Technologie for flexible manual mounting
  - Convection Reflow-Soldering
  - Selective-wave-, light- and vapor phase soldering
  - Au- and Al-conductor bonding
Depended on the requirements of the product application dependance analyses and product qualifications are operated

- **Dependance analyses**
  - Test board for temperature/humidity-cycling and temperature shock
  - Electrodynamical vibration exciter with combined climatic chamber

- **Optical inspections:**
  - X-ray analysis
  - Lightmicroscopy
  - 3D-Laserscanning
  - confocal Laserscanmicroscopy
  - Thermographic-imaging
  - X-ray fluorescence coat thickness measuring
  - High-speed imaging
  - Optical dimensional measurement

- **Destructive inspections**
  - Peel-test
  - Pull- and shear-test
  - Grinding surface pattern analysis
Cooperation partners and Contact

René Schramm
University Erlangen-Nuremberg
Lehrstuhl FAPS
Fürther Straße 246b
90429 Nürnberg
midaz@faps.uni-erlangen.de
Tel.: +49.911.5302-9085

The project MIDAZ is funded by the EU structural funds EFRE: „European Fonds for Regional Development“
Prof. Dr.-Ing. Jörg Franke

Lehrstuhl für Fertigungsautomatisierung und Produktionssystematik

Friedrich-Alexander-Universität Erlangen-Nürnberg

Egerlandstraße 7-9  Tel.: +49.9131.8527569
D-91058 Erlangen  Fax: +49.9131.302528
www.faps.uni-erlangen.de

Thanks!