



strain gauges direct printing  
on metallic test body

- **3D/4D Functional materials: isotropic & anisotropic conductive pastes and inks**
- **Pick & Place: Fine pitch 50µm min**
- **Sintering materials for die attach and thermal interfaces**

## Technological axes

Develop and integrate sensors in harsh environments to generate and process data as close as possible to the point of use (process control & monitoring, SHM, predictive maintenance)

Integrate electronic components on surfaces by direct printing on 3D geometries

Co-manufacture mechanical parts with electronic functions printed on surfaces and in volume using additive manufacturing and topological optimization

Manufacture new mechatronic functions for sensors and actuators in 3D and 4D (shape memory materials)

## Towards mechatronic co-design

Designing electronics from the outset of mechanical design

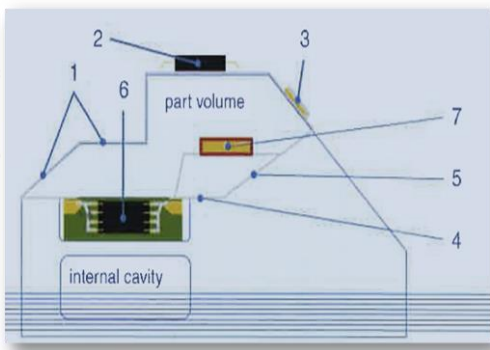
Surface electronics  
Integration of electronic components and interconnections on the surface of an existing object

Volume electronics  
Integration of electronic components and interconnections during the manufacturing of the object using additive manufacturing

Use of isotropically or anisotropically conductive materials deposited in the form of pastes, inks, or varnishes

# Achievements

## ● Technical scheme



Part surface

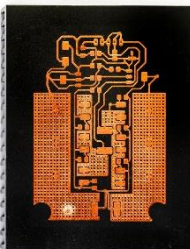
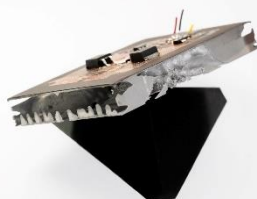
- 1 – surface-integrated conductive path, planar and 3D surfaces
- 2 – surface-mounted packaged sensor/electronic device, planar and 2 ½ D surface
- 3 – surface-integrated sensor/organic electronic device, planar and 3D surface

Part volume

- 4 – volume-integrated conductive path, on build planes
- 5 – volume-integrated conductive path across build planes
- 6 – volume-integrated packaged sensor/electronic device
- 7 – volume-integrated in situ-fabricated sensor/organic electronic device

↑ Built planes,  
Building direction

## ● Industrial

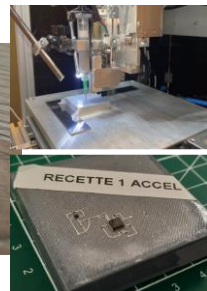


### Direct printing of power circuits and transfer of components onto metal heat sinks

- Elimination of FR4 and thermal optimization
- Reduction in weight, volume, and size

### Direct printing of electronic functions (tracks, pick & place)

- PLA plastic substrate without surface preparation
- Co-production on a single manufacturing method (seamless fab)
- Non planar surface



### Printing of strain gauges

- Improved gauge sensitivity (K factor > 300)
- Simplified manufacturing process
- Optimized test body geometry



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