Ultra-thin chip package (UTCP) and elastic circuit technologies for compact or conformable sensor and electronics assemblies

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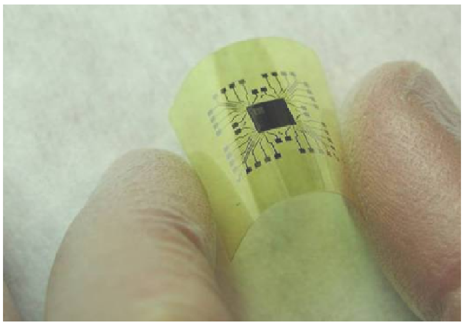
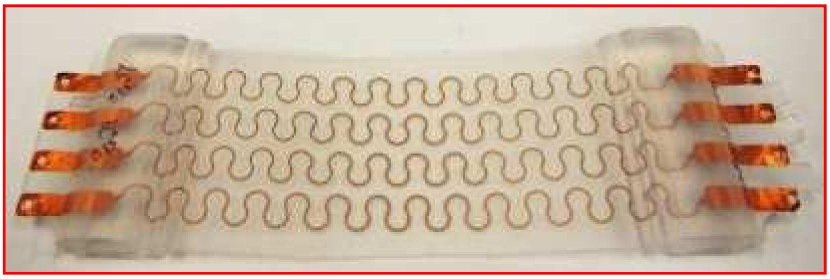
Introduction

In this contribution : presentation of 2 imec technologies, answering needs for miniaturisation and conformability :

- the Ultra-Thin Chip Package



- the Stretchable Circuit Technology

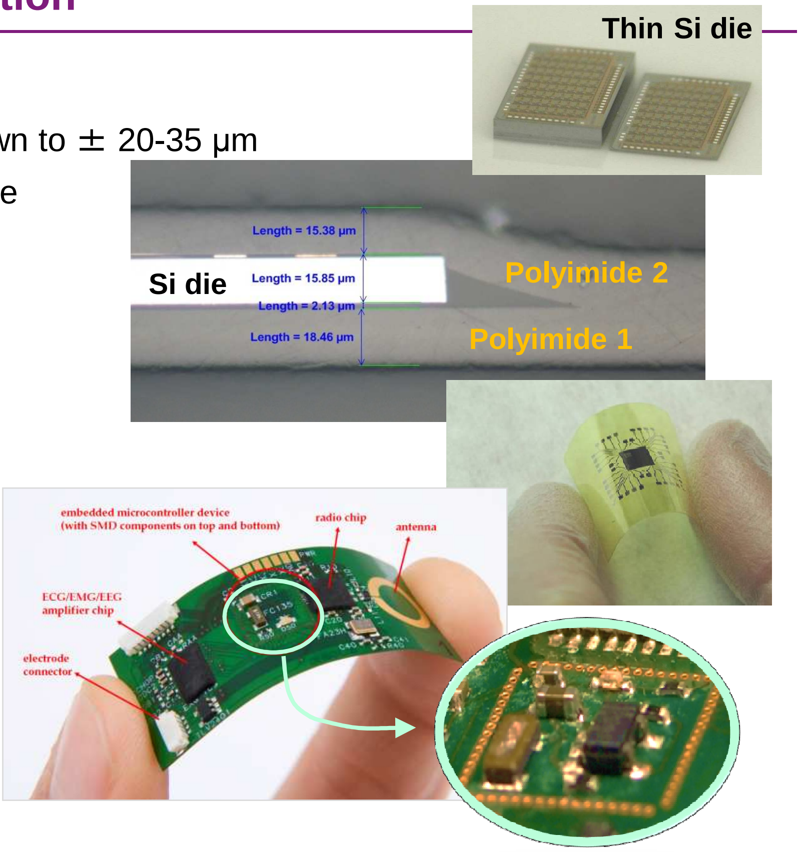


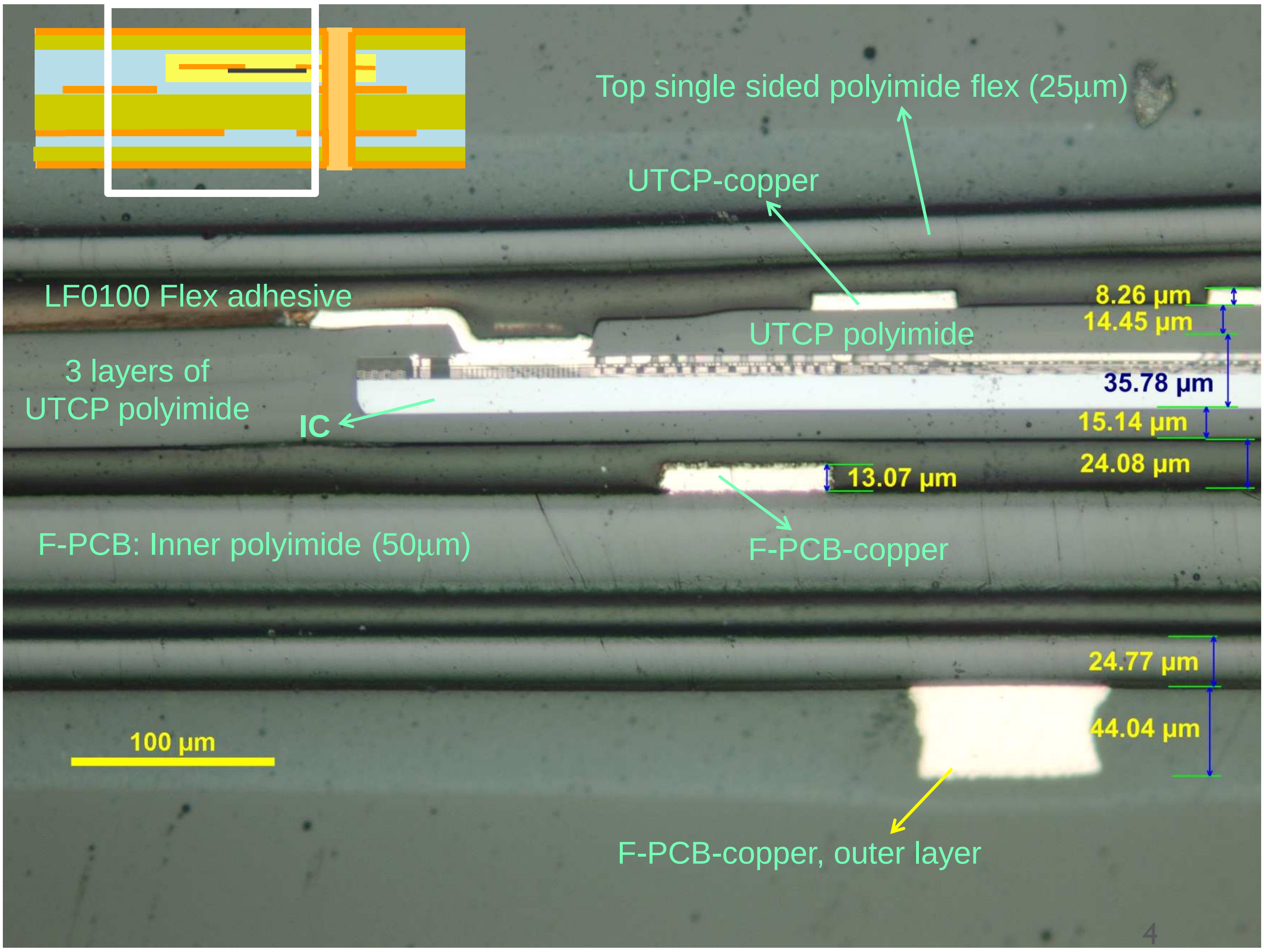
IMEC's Ultra Thin Chip Package (UTCP) and smart UTCP integration

- UTCP in a nutshell:
  - Off-the-shelf dies, thinned down to ± 20-35 µm
  - thin die embedded in polyimide
  - Cu metallisation for fan-out

UTCP :
- Flexible package
- Thin : 50-70 µm

UTCP integration:
- embedding of UTCP in commercial flex PCB
- for volume reduction: place other components on top of UTCP

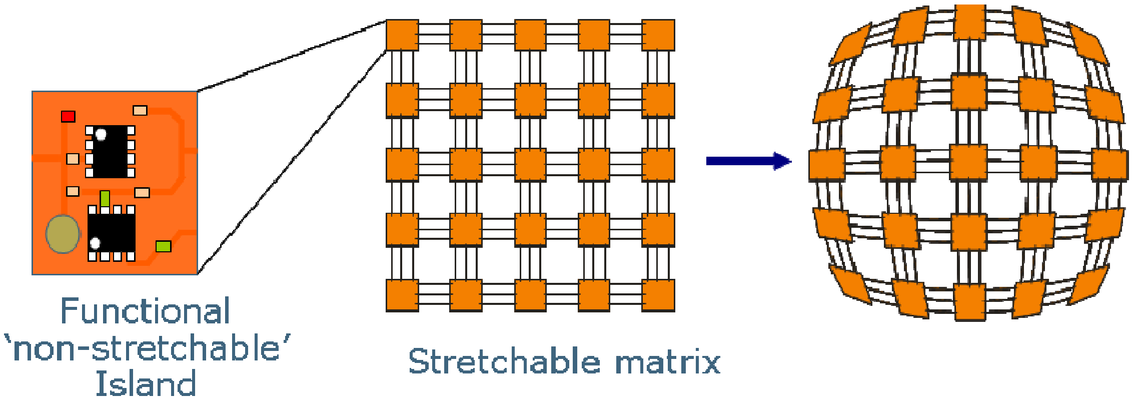




Introduction

Deformable circuit : produce and assemble on flat substrate, shape afterwards

- at least flex → from flat to cylindrical or conical shape
- preferably stretchable circuit → from flat to arbitrary shape



Stretchable circuit = (compact) rigid/flex functional islands with stretchable interconnects

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Introduction

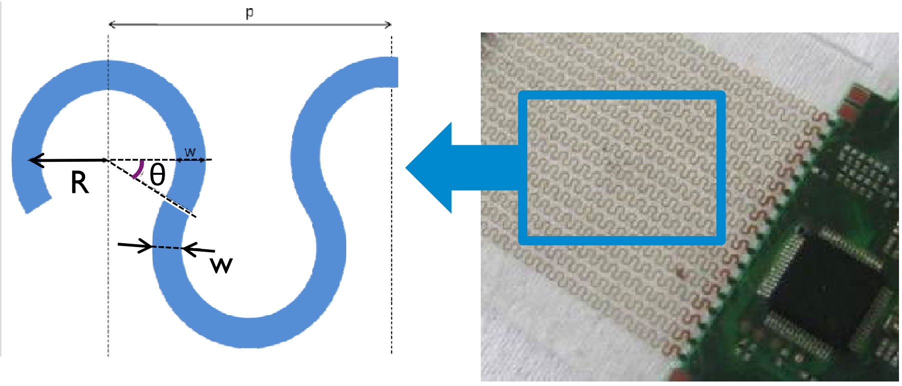
Stretchability of system obtained by

- meander-shaped fine-line metallic conductors

- embedding these in elastic polymer (PDMS, PU)

- Optimization of meander structures through FEM

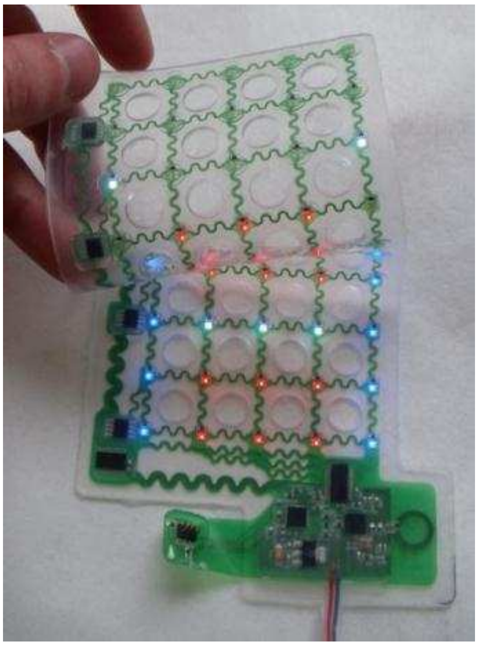
R: radius
w: width
θ: angle



- Metallic conductor
  - **<u>copper foil</u>** (17 or 35 micron thick) for **<u>large area</u>** elastic circuits
  - **<u>Au thin-film</u>** (200nm thick) for fine-pitch **<u>biocompatible</u>** elastic circuits

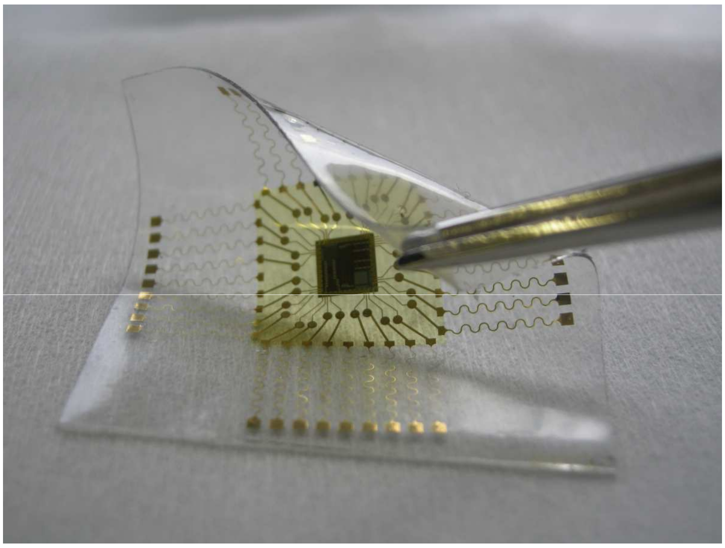
Demonstrators

Party Shirt (5x10 full color led matrix)



Including wireless communication

Thin chip integration - demonstrator



Bendability of Texas UTCP (ultrathin chip packaged)
MSP430F1611 Microncontroller in stretch circuit