

Low temperature assembly method of microfluidic bio-molecules detection device

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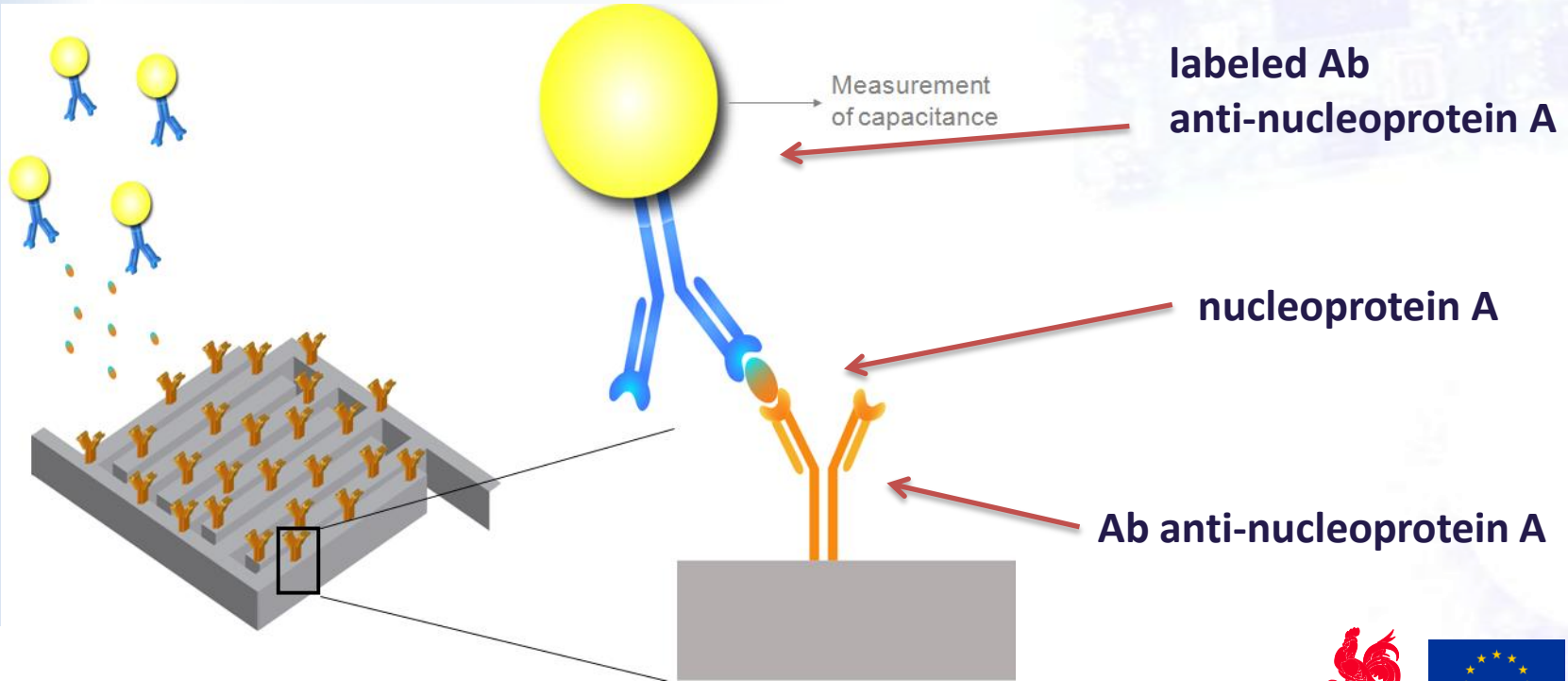
c : Coris BioConcept, Gembloux, Belgium



Principle of detection

- Recognition of labeled proteins on bio-functionalized interdigitated capacitive sensors (IDE)
- measurement of the capacitance variation

- ➔ bio-sensor sensitive to contaminants, high temperature, and UV exposure
- ➔ Need for alternative packaging techniques

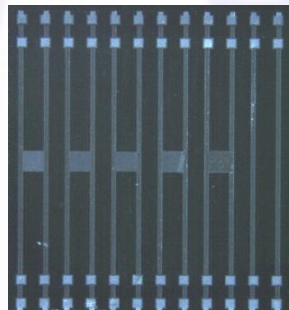


Packaging process flow

Die attach :

High T cure adhesive

→ RT cure adhesive

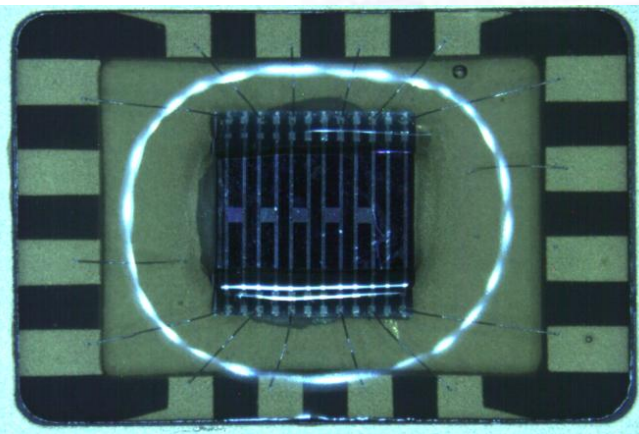


IDAM: 4 sensors and 2 controls on 3 x 3 mm² Si die

Wire bonding :

Gold wire bonding (150 – 220 °C)

→ RT aluminium wire bonding



Sensor die in DIL package with fluidic cavity

Encapsulation :

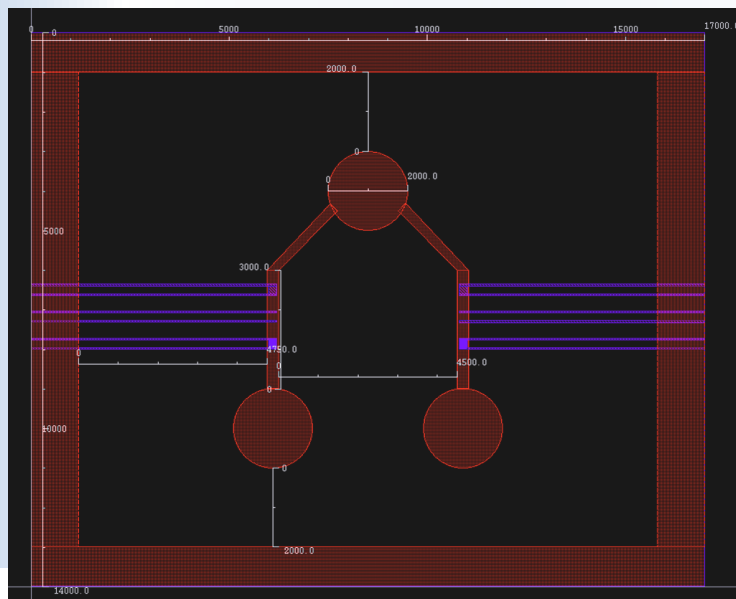
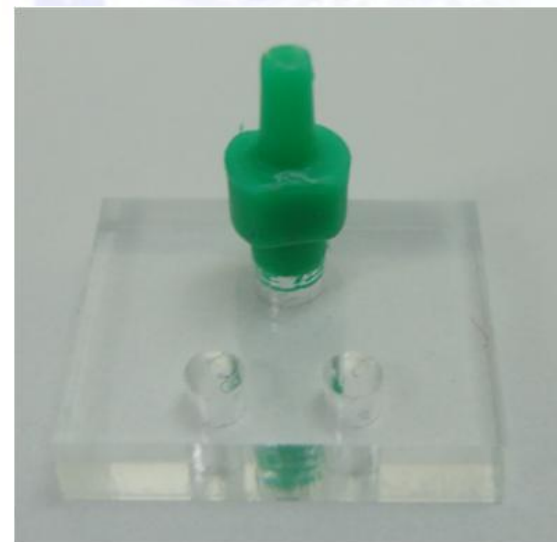
UV curable biocompatible encapsulants

- higher viscosity to define a sensing area
- lower viscosity to encapsulate the Al wires

UV intensity : 18.5 W/cm², wavelength: 320 – 500 nm, duration : max 20 s.

Integrated microfluidic chip with two sensing areas inside microfluidic channels for differential detection on silicon die with PMMA cover.

- Silicon die : 17 x 14 mm²
- KMPR resist : 120 μm thick, 14.6 x 12 mm²
- 2 channels : 300 μm wide
- Transparent PMMA cover : 14.6 x 12 mm²
- 2 inlets, 1 outlet : 2 mm diameter

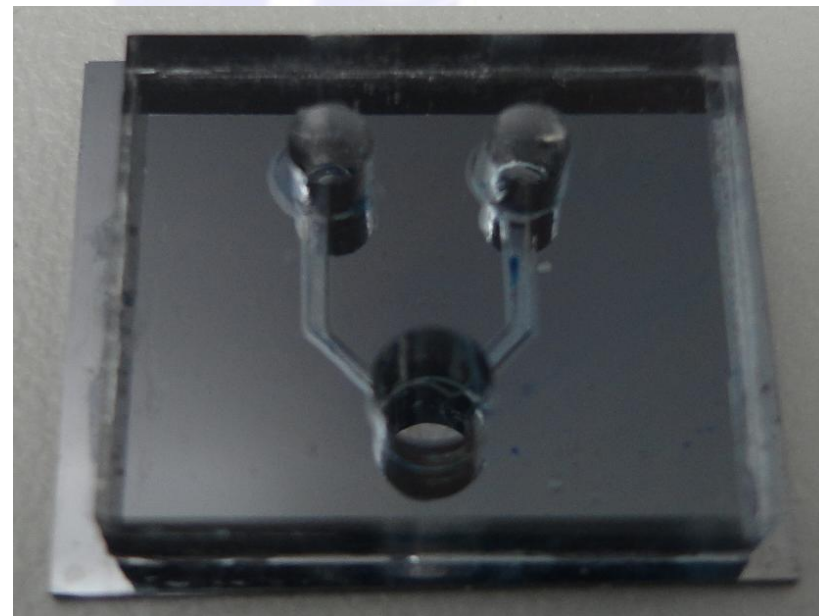
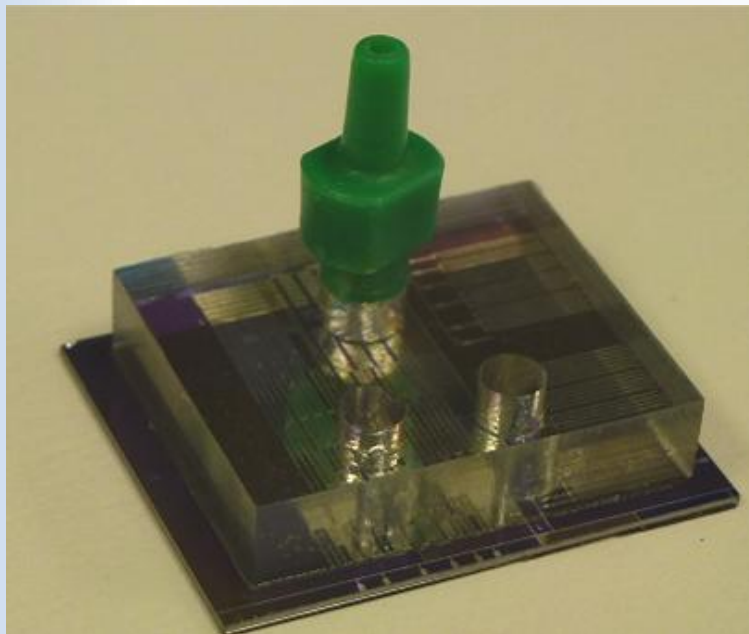


Bonding of the PMMA cover to the chip :



The conventional methods (thermal, plasma activation, and solvent bonding) are not suitable

➔ Biocompatible low temperature adhesive



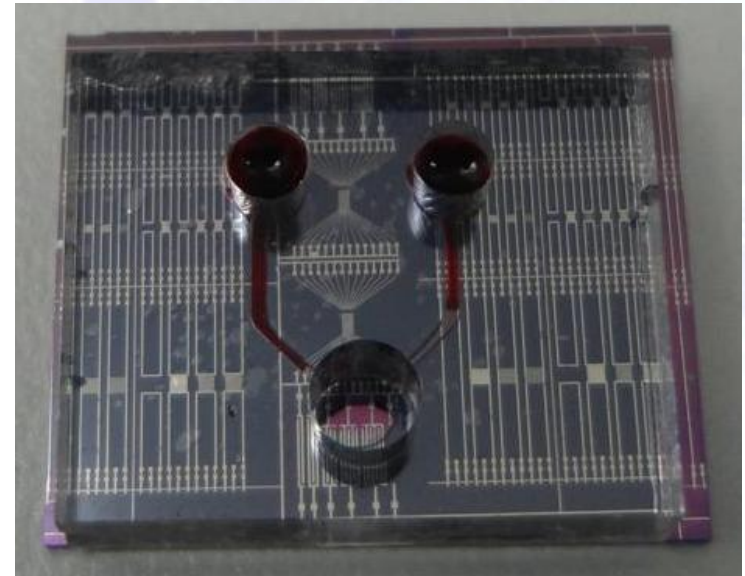
First step :

- dispensing of epoxy adhesive on the KMPR (EPO-TEK® 301), RT
- Deposition of the PMMA cover on the chip with visual alignment

Second step :

- dispensing of epoxy adhesive on the PMMA, half cure (30 min at 60°C)
- PDMS stamp
- Deposition of the PMMA cover on the chip with visual alignment

- Ink test confirmed gross-leak tightness



- We developed low temperature assembly methods which cause no damage to the biological layer grafted on the bio-sensor