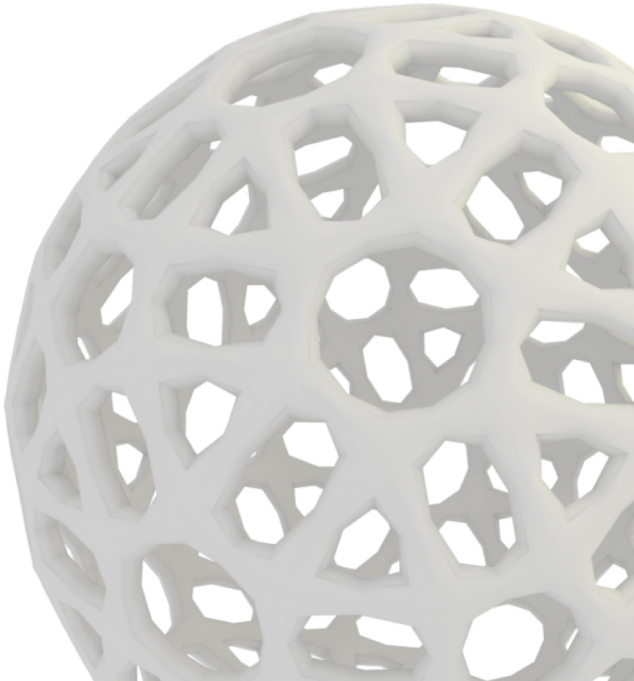
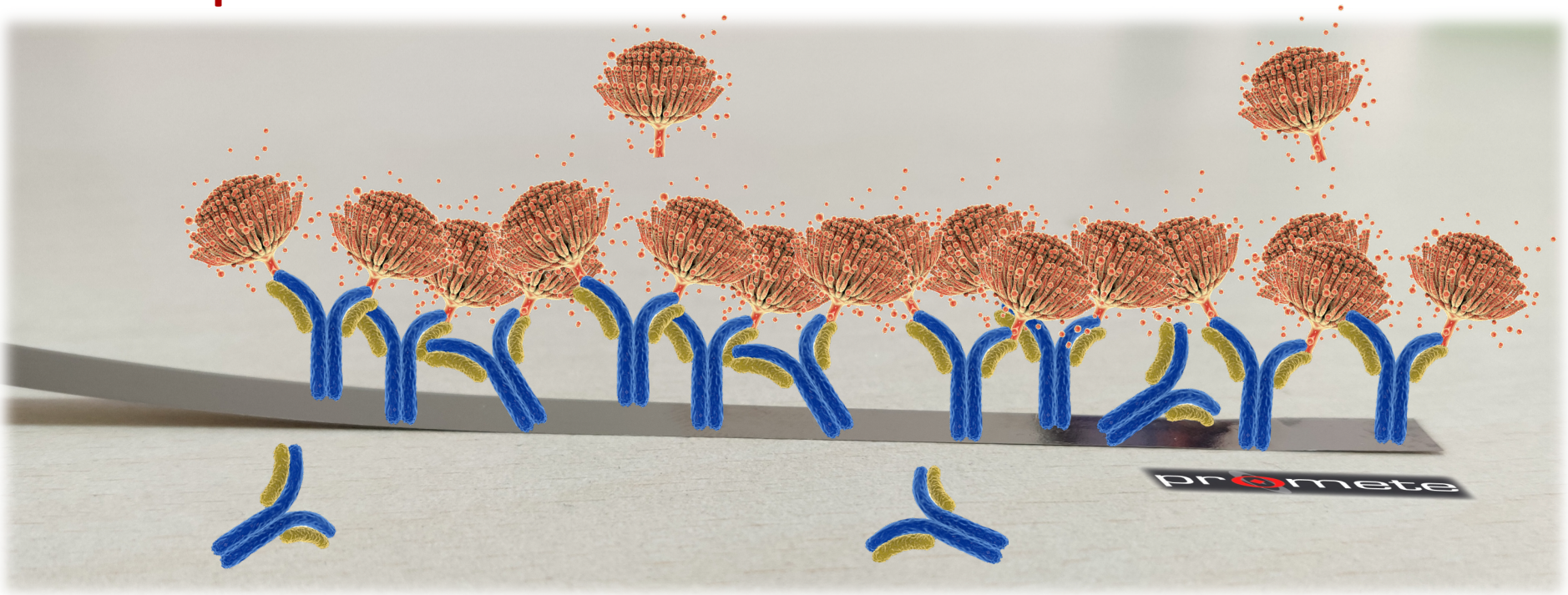
Magnetoelastic biosensor
for the rapid and economic detection of food pathogens

promete



Description and features



The biosensor can detect the concentration of food pathogens (or any kind of analyte) from the variation of the mechanical resonance frequency of the magnetoelastic transducer

Description and features

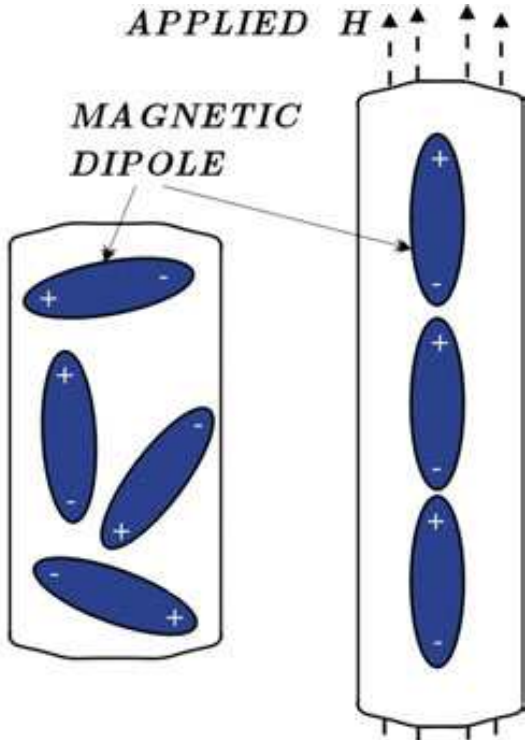
It takes advantage of three main physical mechanisms:

1. Magnetostriction of amorphous ferromagnetic (iron-based) alloys

2. Generation of longitudinal magnetoelastic waves

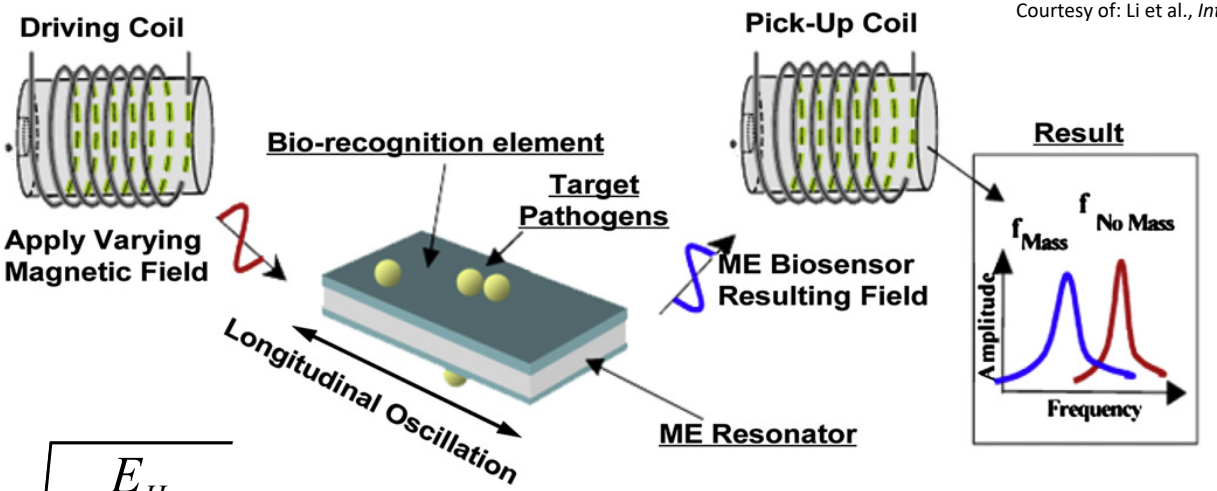
3. High specificity and affinity thanks to the photochemical immobilization of appropriate antibodies

Mechanism 1: magnetostriction



Magnetostrictive materials (such as Metglas) mechanically deform (expand or contract) if subjected to an externally applied magnetic field, due to the rotation of the randomly oriented magnetic domains, resulting in a variation of the total magnetization that can be measured remotely using a magnetic field detector, such as a pickup coil.

Mechanism 2: magnetoelastic wave



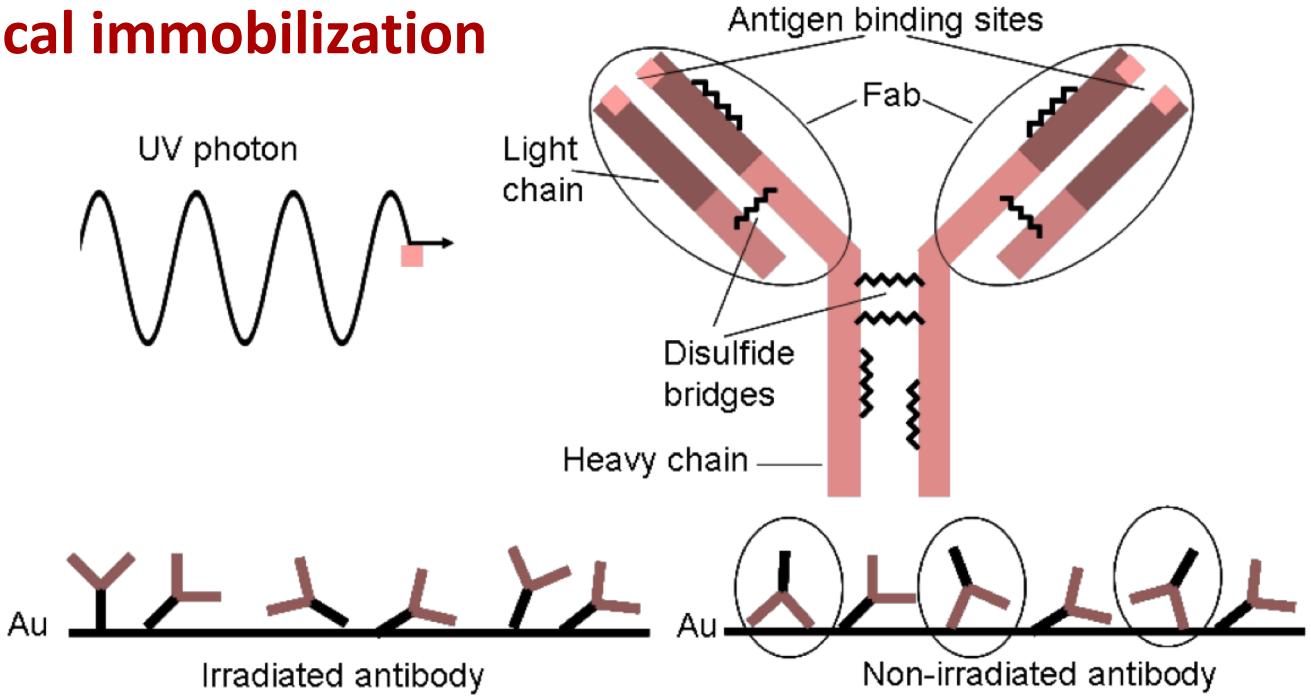
Courtesy of: Li et al., *Intermetallics* **30** (2012) 80

$$f = \frac{1}{2L}\sqrt{\frac{E_H}{\rho(1-\sigma)}}$$

$$\Delta f = f_{mass\ loaded} - f_o = -f_o \frac{\Delta m}{2m_s}$$

When the material is subjected to a time-varying external magnetic field, it mechanically vibrates and a longitudinal magnetoelastic wave is generated with a well-defined characteristic resonance frequency. Such a frequency strongly depends on both the material geometry and its mass. Hence it can be used to detect micrometric deformation (microstrain) of the tape and/or very small mass variations.

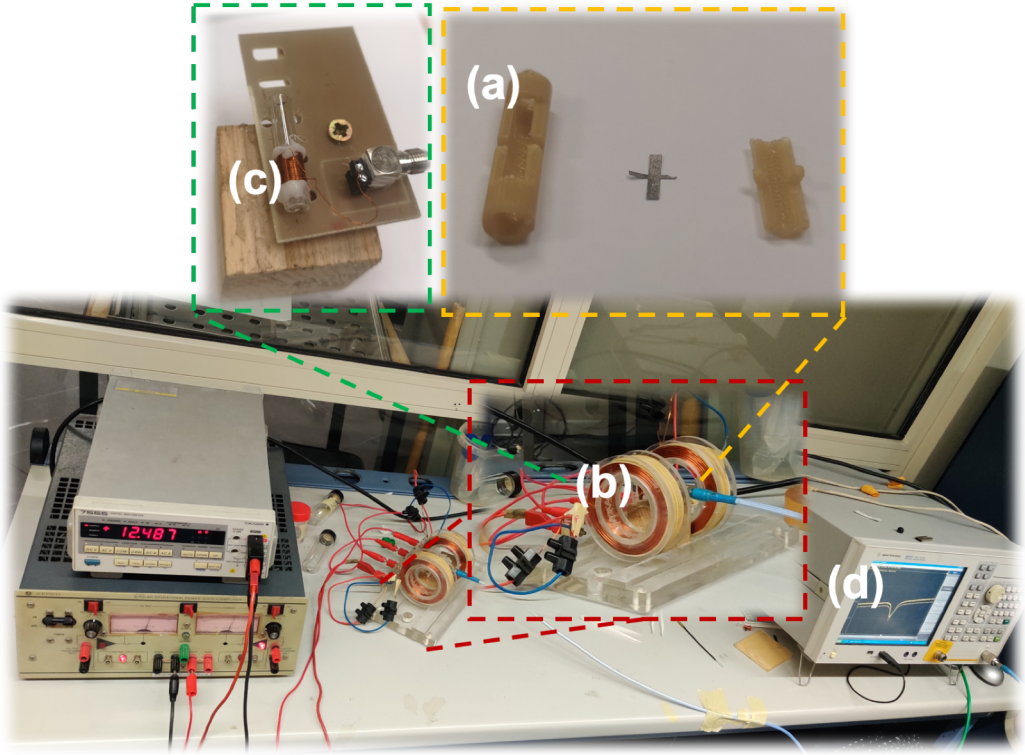
Mechanism 3:
photochemical immobilization



B. Della Ventura, et al. "Light assisted antibody immobilization for bio-sensing", Biomedical Optics Express 2 (2011)

UV irradiated antibodies are immobilized on the Au surface and properly oriented thanks to formation of thiols groups

Hardware 1: test setup



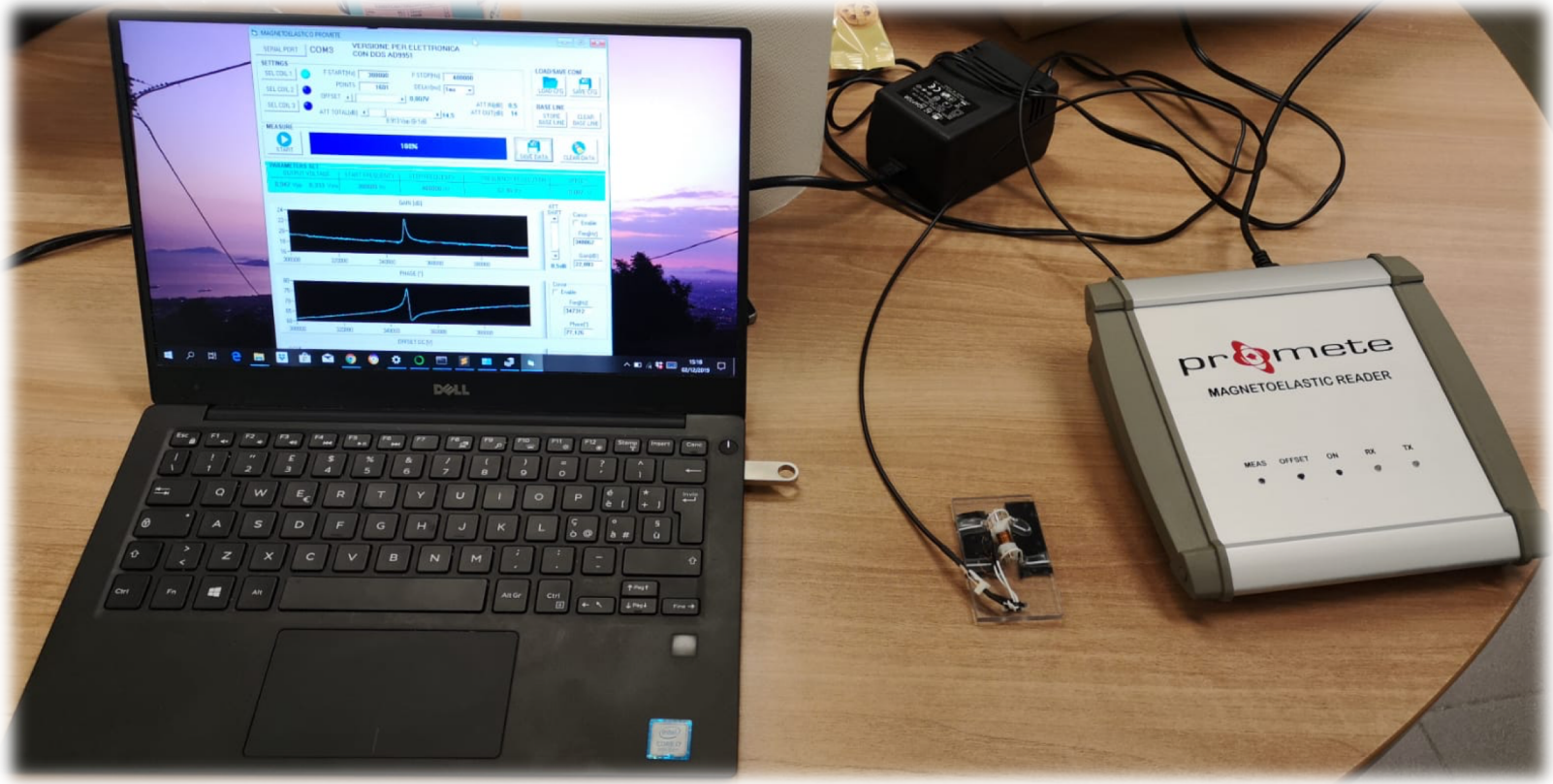
a) Metglas strip and a hosting cell

b) Helmholtz coil to apply DC polarization field

c) Coil for drive and detection of the RF field

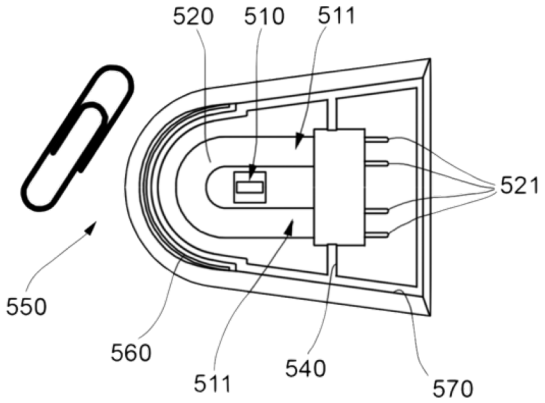
d) Instrumentation for RF signal (Vector Network Analyzer in the photo)

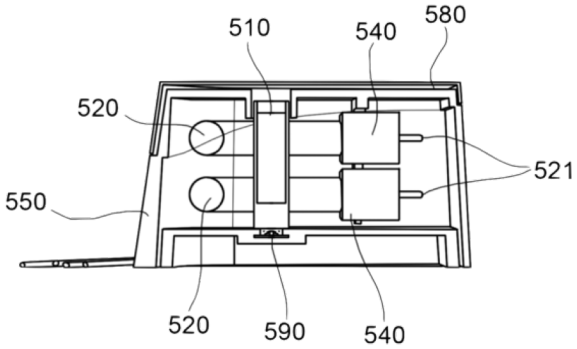
Hardware 2: compact readout electronics



Hardware 3:

surface functionalization





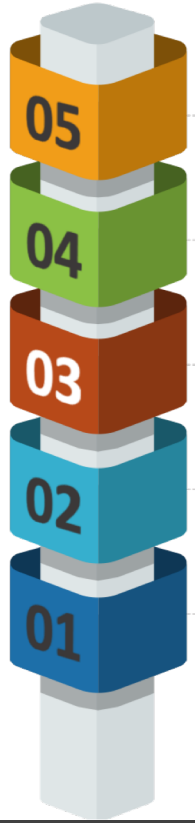
B. Della Ventura, et al. "Light assisted antibody immobilization for bio-sensing", Biomedical Optics Express 2 (2011)

Photochemical Immobilization Technique implemented via UV lamp

UV lamp functionalization, intellectual property: 202018000003368

Production cycle

- buy
- make

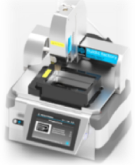


final assembly

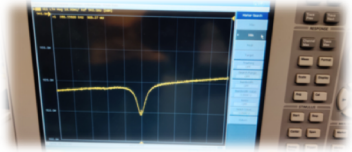
laser cut & coating

raw material & polishing

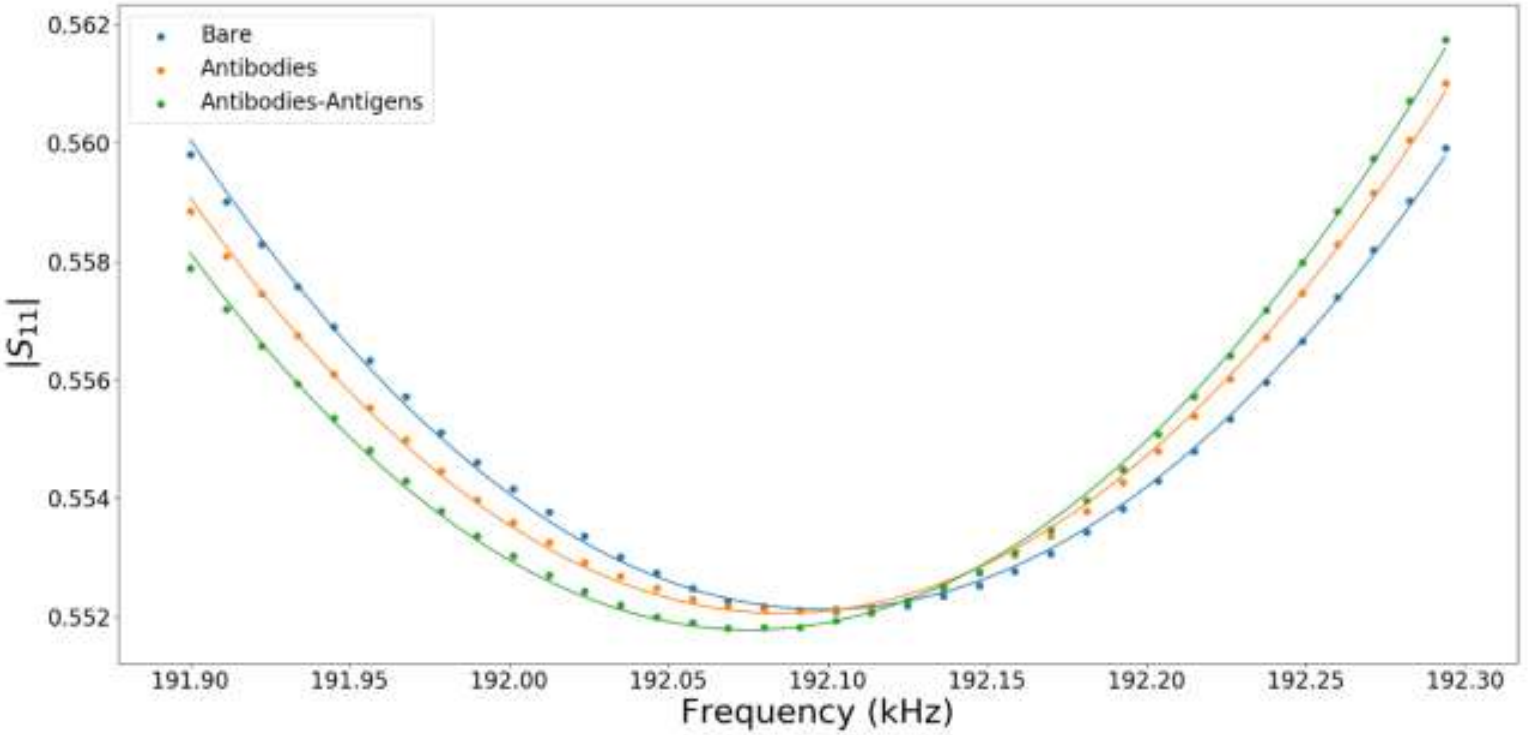
microfluidics & functionalization



quality test



Preliminary measurements



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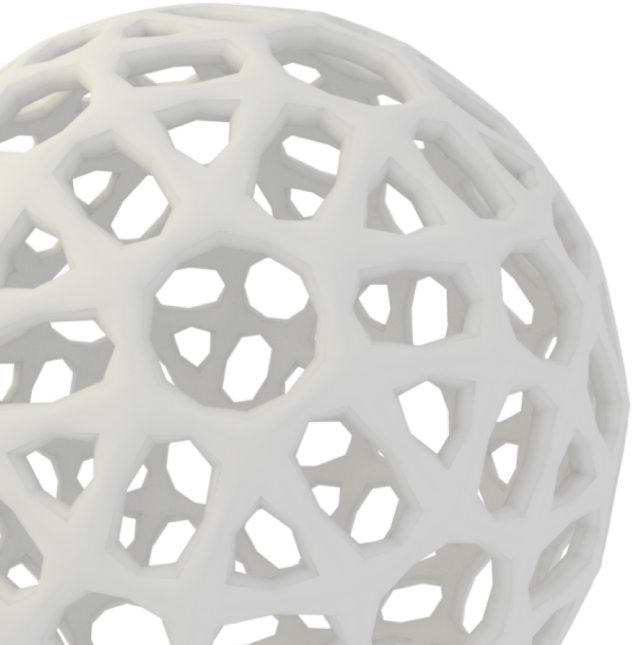

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