

# 生研公開 藤田・年吉研

## Integrated CMOS-MEMS Sensors

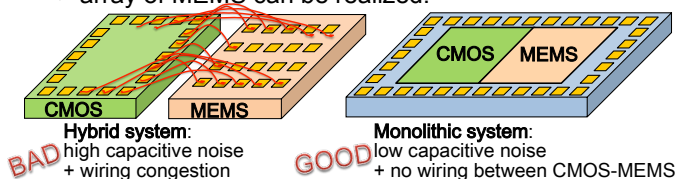
### Example of a Wireless Electro-Chemical Sensor

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Integration of sensors and data analyses systems on a same chip allows further miniaturization, parallel analyses, reduction of parasitic noise due to wiring, and autonomy. The advancement in technology allows now to realize single chip integrated devices, opening the door to new functions and applications to standard sensors systems, for more diversified analyses. We present here the advancement of the research on a wireless electro-chemical sensor.

### Introduction

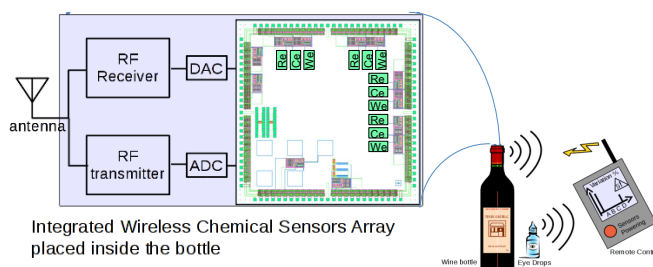
- Thanks to the advancement in technologies, integration of MEMS with LSI devices is accessible.
- 1990's: First MEMS-LSI integrated devices for **accelerometers and microphones**.
- 2000's: Emergence of integrated MEMS-LSI **chemical sensors**.
- 2010's: New applications with **wireless sensors** and **biological applications**.
- Advantage of integration: **no MEMS-LSI wiring**:  
=> reduction of capacitance noise: low value of parameter can be detected.  
=> array of MEMS can be realized.



- Here we present a Wireless Integrated CMOS-MEMS Electro-Chemical Sensor for measurements inside closed containers.

### Principle

- For analyses inside a closed container (bottle): beverage or medicine applications.
- System placed inside the container.
  - CMOS-MEMS Electrochemical Sensor integrated with some converters and RF system.
  - The antenna might be the cap of the container itself.
  - The sensor is activated from the outside by means of a remote control.



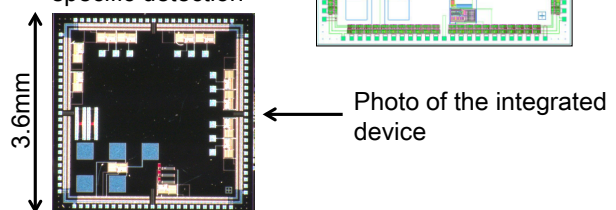
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### Wireless Electro-Chemical Sensor Fabrication Principle

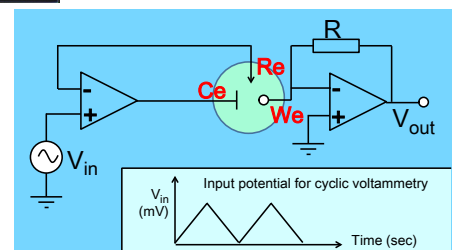
**Integrated Potentiostat with 3 micro-electrodes: Working Electrode (WE), Counter Electrode (CE), Reference Electrode (RE).**

**Not functionalized WE** to inform about the signature of the mixture

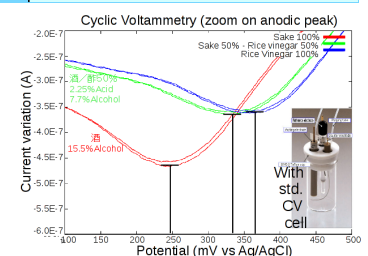
**Functionalized WE** for specific detection



**Potentiostat for 3 electrodes electro-chemical measurements.**



Typical result of **cyclic voltammetry** to detect sake deterioration, with standard EC cell: imitation of sake oxidation (becomes vinegar).



### Conclusion

A Wireless Integrated CMOS-MEMS Electro-Chemical Sensor for measurements inside closed container is presented here. Integration of the sensing part is on going and under tests. Future version of the system will also integrate converters and the wireless part.