
Intelligent food packaging

RFID bio-based sensing label to monitor food shelf life



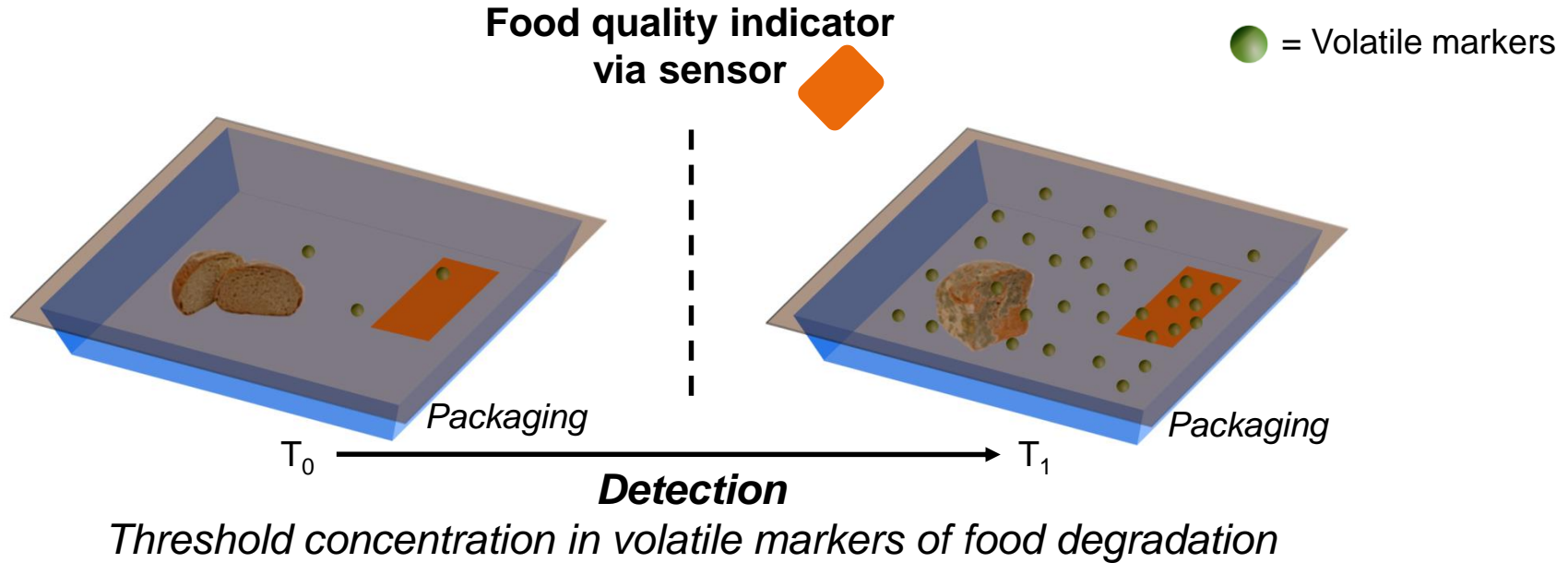
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Co-directors: Carole GUILLAUME, Brice SORLI

Objective

Development of the sensing bio-material



Coupling of RFID (Radio Frequency Identification) tag with the sensor

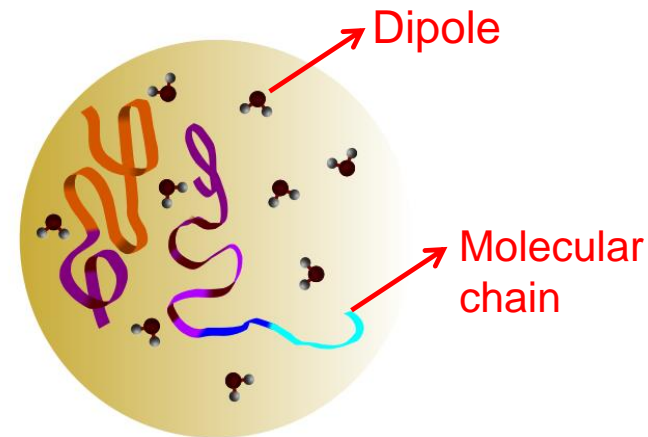
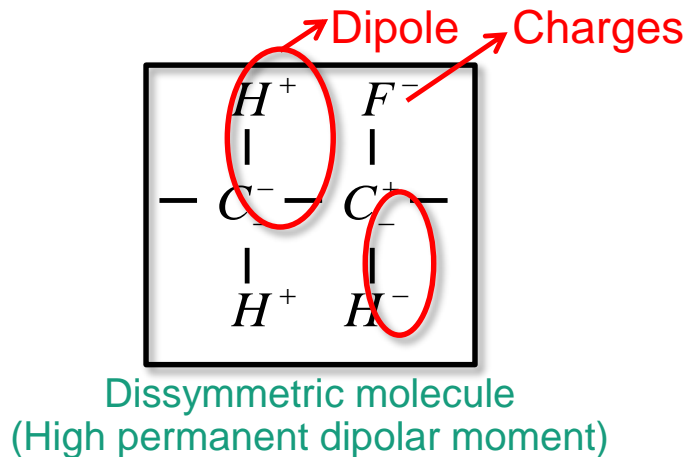
RFID: Wireless system for transferring data from a tag attached to an object



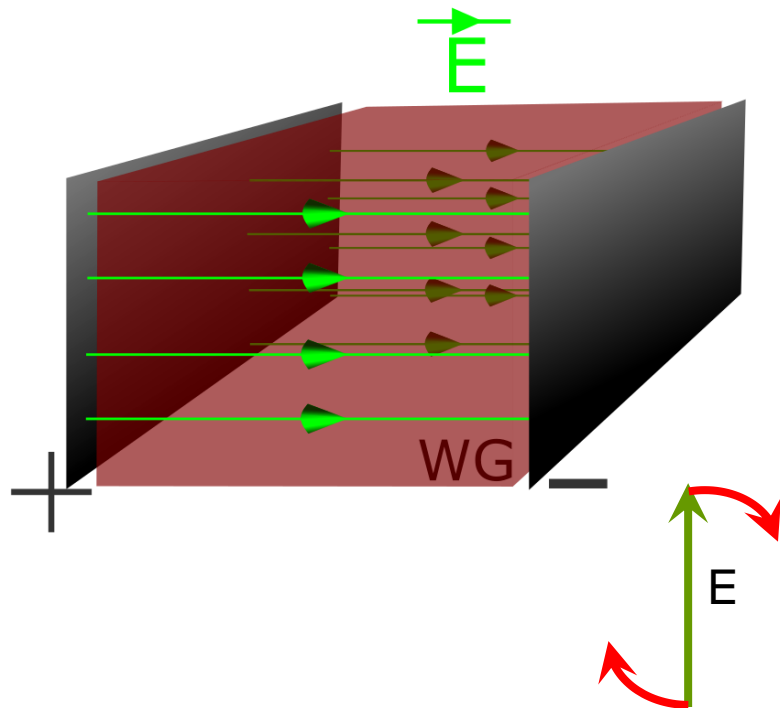
Sensor: Dielectric material

Vegetal protein: Wheat Gluten

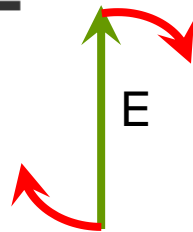
- “bio” material and can be coated onto a substrate.
- displays sensitivity to gases and vapors (considered as food quality markers).
- exhibits electrical properties and dielectric properties (Dipoles, charges, charged molecular chains).



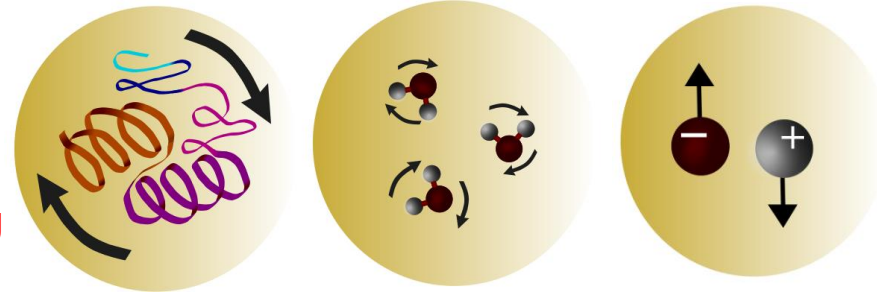
Effects of electric field on Wheat Gluten



- Alternating electric field impacts:
 - Movement of molecular chain,
 - Rotation of dipoles,
 - Movement of charge.



Alternating field

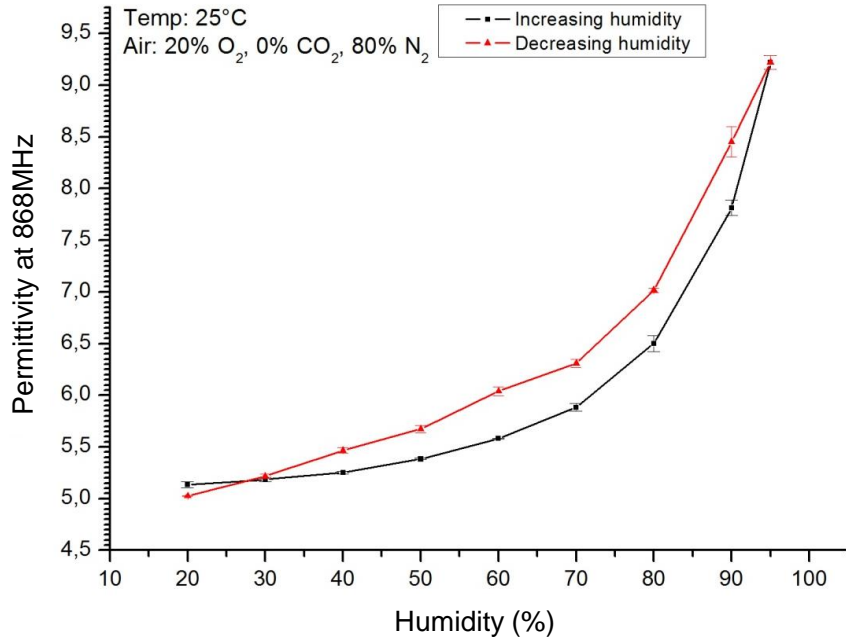


⇒ Energy induced in the wheat gluten material.

⇒ **Energy stored** (dipoles, polarization): rep. by **permittivity (ϵ')**.
⇒ **Energy loss** (conduction, friction): rep. by **dielectric loss (ϵ'')**.

Effects of relative humidity (RH) on wheat gluten

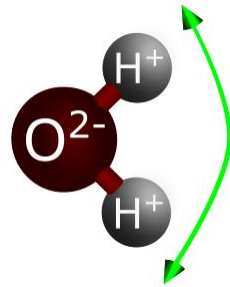
Permittivity



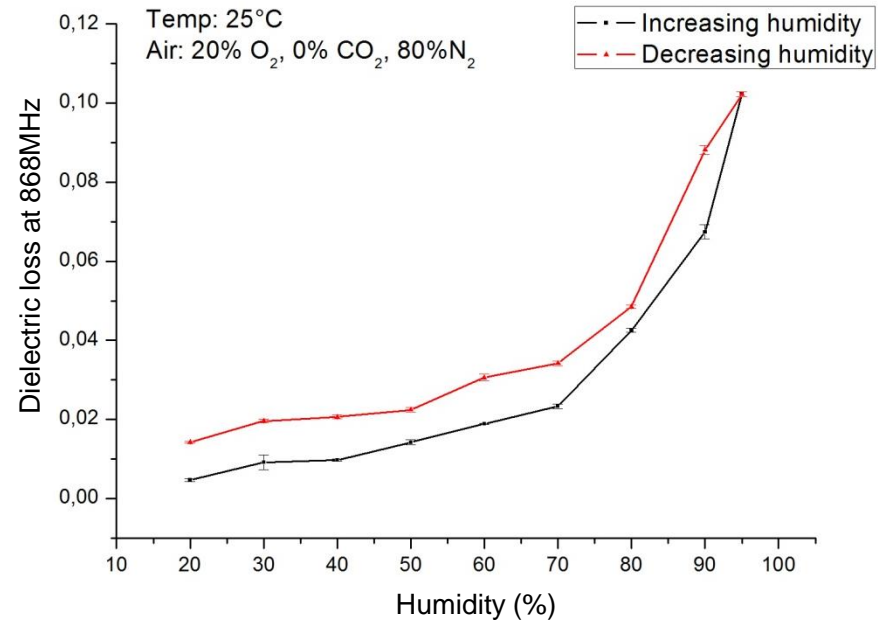
Increase of permittivity with increase in RH.

- More polarizations because of water (dipole).
- Increase mobility of molecular chain and dipoles.

(Electromagnetic properties: Dielectric properties of food)

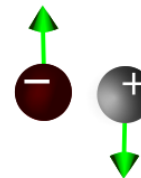


Dielectric loss



Increase in dielectric loss with increase in RH.

- Increase mobility of charges in the network. (J.Ahmed, 2007).
- Lossy medium. (S.Ryyniinen, 1995).



RFID (Radio Frequency Identification)

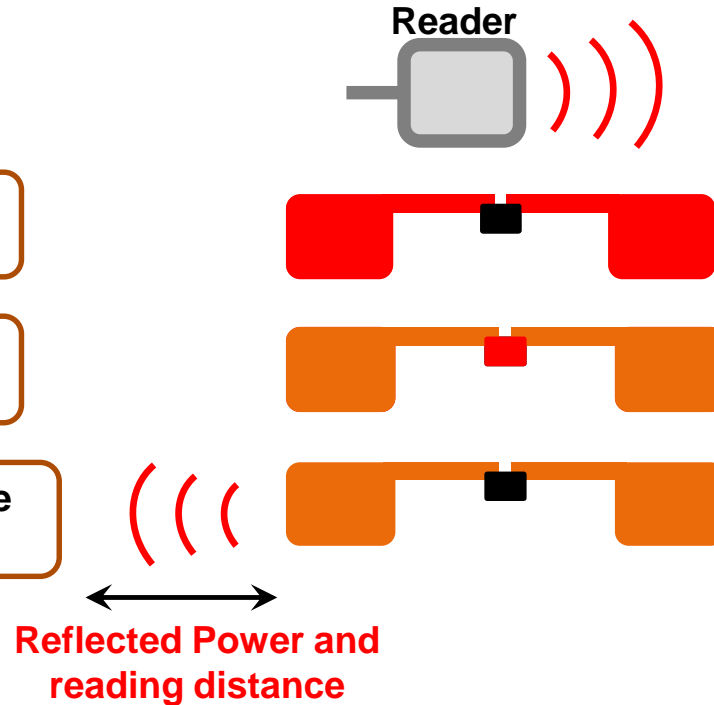
How does RFID work?

Wave emission

Wave captured by the antenna

Power supplied to microchip

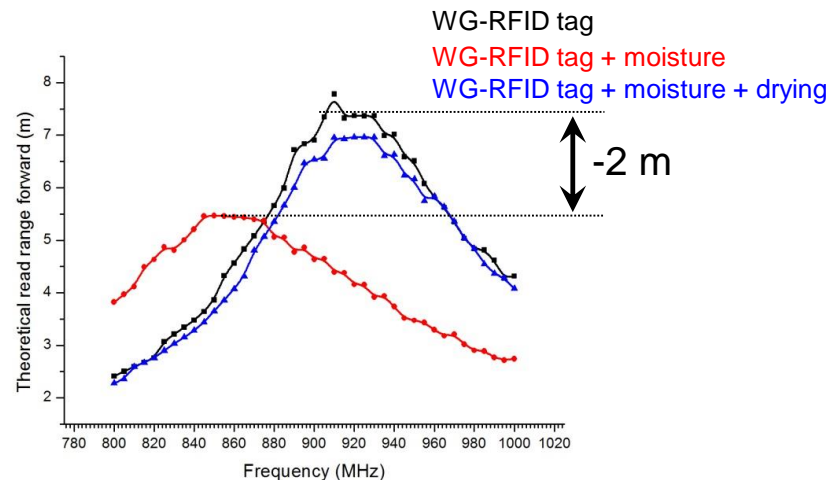
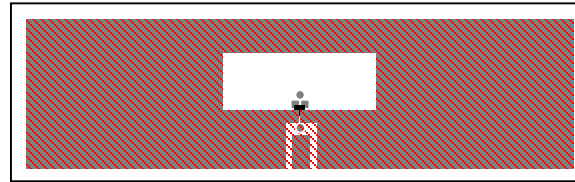
Wave emitted back to the reader



RFID + wheat gluten coated : Effects of relative humidity

- Effects of humidity on wheat gluten (permittivity and dielectric loss) => Modification of electrical property of RFID antenna.
 - Modification in reflected power.
 - Modification in reading distance.

RFID tag with wheat gluten layer deposited – Impact on reading distance



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Thank you for your attention!!