Gas sensor window

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PASTEUR project

Food industry annually discards $35,000,000,000 worth of food, households throw away $380 per year. The goal of the PASTEUR project is: "To develop a wireless sensor platform to monitor environmental conditions of perishable goods in the supply chain."

Sensor window

The sensor chip contains a humidity sensor and electro-chemical gas sensors for O₂, CO₂ and C₂H₄. The sensor is covered by a polymer membrane that acts as the sensor window:
(a) Stop dust particles/water droplets
(b) Only permeable to the target gas to increase selectivity
(c) Actuation reduces the response time and increases sensitivity

PDMS membrane

PDMS (Polydimethylsiloxane) has high gas permeability, it is fabricated by spincoating and patterning with excimer laser ablation.

2 Generations of roughness exist:
(a) Micrometer by laser-pattern
(b) Nanometer by ablation process

Super-hydrophobic: Contact angle of 160-170° for untreated PDMS. This causes the surface to be water-repellant and self-cleaning.

Ablation causes a permeability increase by 10-20% for all gases. This is caused by the increase in surface area and thus in the absorption rate, as permeation is the combined effect of sorption and diffusion.

Conclusion & outlook

The super-hydrophobic membrane shows a high permeability and is a good barrier against condensed water. Additionally it has a self-cleaning effect. Further investigation will now be done to gas-perm-selective materials to enhance the sensor selectivity. Also an active system will be designed to further optimize this selectivity as well as the sensitivity and response time of the sensors.