Passive Wireless Sensing

John Batchelor

Communications Research Group, School of Engineering and Digital Arts,
The University of Kent

j.c.batchelor@kent.ac.uk

Various published passive gas sensing RFID tag concepts have the premise that a 'sensitive' material changes its permittivity/conductivity as a function of exposure to some stimuli, shifting the tag resonant frequency, and leading to entirely passive, thin, low cost and disposable wireless sensors. Activation energy is supplied by received radio signals.

Our different approach to signal transduction utilizes the mechanical swelling of an underlying film to modulate the RFID response. This enhances signals compared to sensing through substrate permittivity change. Since the response depends on the film substrate bulk properties, fabrication of the selective films remains cheap and amenable to simple chemical/formulation modification.

Simple polydimethylsiloxanes (PDMS) were chosen for their ability to selectively swell to varying degrees upon exposure to different organic solvents. Their use in solid-phase microextraction is well documented and integral to that field. We have utilised their swelling abilities in the presence of organic vapours and have determined that swelling degree is dependent upon not only the Hansen solubility parameters of the solvent vapour but also the vapour pressure. We have demonstrated that the RFID response is directly proportional to swelling degree and consequently to the general identity of the organic vapour.