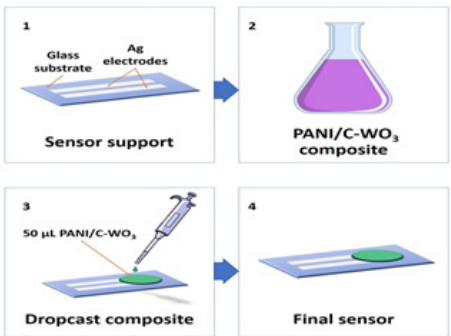
Electrochemical PANI / cellulose / WO3 sensor to detect acetone derivatives in the breath of patients with diabetes mellitus

Velia Osuna, Rocío B. Domínguez and **Alfredo Márquez-Lucero**
CIMAV-CONACYT México

The concentration of acetone derivatives in human breath was reported within 300–900 ppbv for healthy subjects and 1800 ppbv for diabetic subjects [4, 5]. This is why acetone derivatives are proposed as biomarkers present in human breath for clinical analysis of diseases such as Diabetes Mellitus (DM). Chemical sensors based on semiconductor metallic oxides (SMO) have emerged as an active research area. In those sensors, the surface is modify by adsorption of gas species and space charge effects, affecting their conductivity. When SMO sensor is exposed to reducing conditions, the adsorbed oxygen is removed by reaction with the reducing gas and the reinjection of electrons reduces SMO resistance. Since acetone acts as a reducing gas, detection by sensors such as ZnO [7], In2O3 [8], and SnO2 [9] has been previously studied but among SMO materials WO3 has been proposed as the most

suitable material for acetone sensing [10]. WO3 is a ℼ-type semiconductor with a band gap between 2.6 and 3.0 eV [11]. Adsorbed oxygen species on WO3 causes the transfer of electrons from WO3 conduction band to form O2− and O− species. The interaction of a reducing gas, such as acetone with the chemisorbed oxygen, releases an electron to the conductance band of WO3, which decrease its resistance.



In order to improve the WO3 sensitivity, doping with carbon sources such as glucose and cotton has been reported as an effective strategy to reduce the band gap value, improvingWO3 semiconductive characteristics [12]. In this work, a nanocomposite of PANI and WO3 doped with carbon derived from cellulose (C–WO3) was proposed for acetone detection at room temperature. The sensor was fabricated with two silver electrodes over an inert substrate with the PANI/C–WO3 composite deposed in between. Sensibility of the device was evaluated by EIS at room temperature.

e: alfredo.marquez@cimav.edi.com