Detection of Breath Biomarkers for Alzheimer's and Parkinson's disease using Quartz Tuning Forks Based Gas Sensors

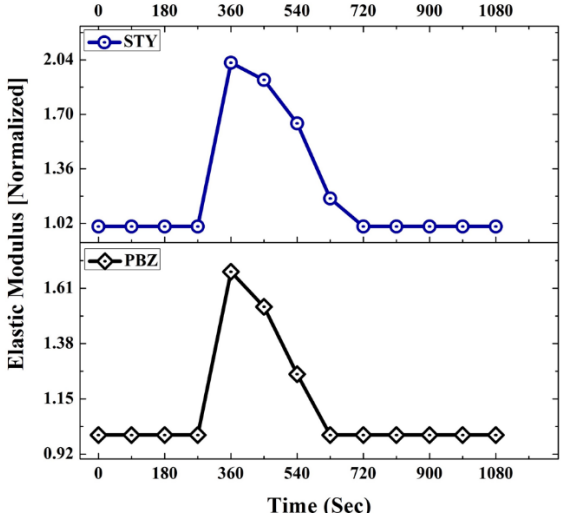
Saurabh Parmar[1], Bishakha Ray[1], and Suwarna Datar[1]

[1] Department of Applied Physics, Defence Institute of Advanced Technology (DIAT: DU) Pune, India.

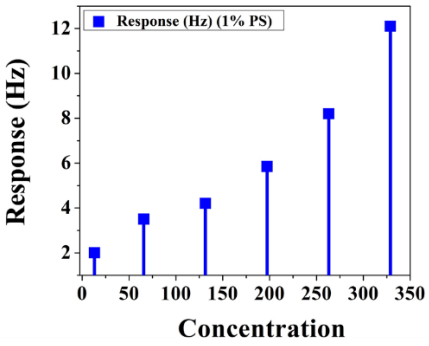
Alzheimer's (AD) and Parkinson's (PD) disease are two of the most life-threatening neuro-degenerative diseases. Due to the complex nature of the diseases, diagnosis of AD and PD in the initial stages is very difficult. Recently, studies concentrating on detection of diseases with the help of breath biomarkers have proven to be effective. In this work, we detect two reported volatile organic compound (VOC) breath biomarkers of AD and PD namely styrene (STY) and propyl benzene (PBZ) using quartz tuning fork (QTF) based sensors. These QTFs are modified using polymer films to achieve selectivity. We demonstrate that polymer modified QTF based sensors can detect these analytes with high accuracy even at low (ppm) concentrations. The polymer was selected based on results obtained from Force Spectroscopy studies where we detect the change in elastic modulus of the polymer film upon interaction with the VOCs. Based on the working principle of the sensor, few parameters like recovery time (RcT), response time (RpT) and drop in frequency (Δf) among others can be utilized for better classification. The data collected from the sensor is used to classify the behaviour of the two analytes using machine learning techniques with approximately 90-95% accuracy.

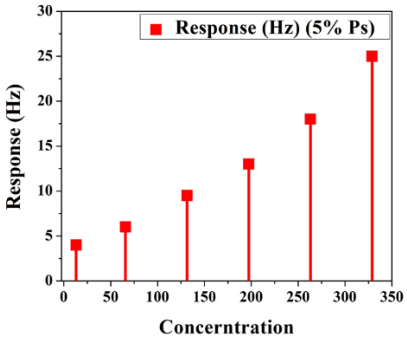
Keywords: Biomarkers; Quartz Tuning Fork; gas sensors; breath analysis; machine learning; Alzheimer's (AD); Parkinson's (PD)

Variation of Elastic Modulus of PS film on grid when exposed to Styrene and Propyl Benzene



Response Summary For Styrene





Response Summary For Propyl Benzene