HIGHLY SENSITIVE POROUS SILICON SENSOR: DETECTION OF ORGANIC VAPOURS USING PHOTOLUMINESCENCE QUENCHING TECHNIQUE

Saakshi Dhanekar[1], S.S. Islam[1,*], T. Islam[1], Harsh[2]

[1]Nano-Sensor Research Laboratory, D/o Applied Science and Humanities,

Jamia Millia Islamia (Central University), New Delhi – 110025, India

[2]Solidstate Physics Laboratory (Defense Research & Development Organisation),

Teemarpur, Delhi – 110054, India

*Corresponding Author: safiul_el@rediffmail.com

Abstract- Porous silicon based sensors were tested in the presence of various linear aliphatic alcohols (methanol to n-hexanol) and water in the range of 10-100 ppm by photoluminescence quenching technique. An increasing trend in the degree of quenching was observed with the chain length of alcohols while minimum response was given to water. Sensitivity as high as 80-90% and nearly instant response time has proven the sensors to be highly efficient. Photoluminescence quenching phenomena is discussed on the basis of charge transfer mechanism between the host and the vapour-induced surface states, but the degree of quenching and anomalous response as a function of chain length suggests no unique quenching theory for estimating the sensitivity for the set of alcohols tested. From methanol to butanol, the sensitivity was dependent on the effective concentration of analytes in the porous silicon matrix, while for pentanol and hexanol having high boiling point, the sensitivity was linked to dielectric quenching mechanism due to the condensation of vapours inside the pores.

Index Terms: organic vapour, photoluminescence quenching, porous silicon, Raman, sensor