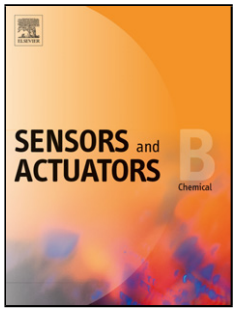

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LSPR based Ultra-sensitive low cost U-bent optical fiber for volatile liquid sensing

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Highlights:

- A cost effective localized surface plasmon resonance based U bent optical fiber sensor has been proposed entailing noble metal nanoparticles where evanescent wave coupling of nanoparticles has been exploited.
- The novelty of the proposed sensor lies in its simple, inexpensive and miniaturized optics design with quick response towards concentrations of target analytes.
- The sensing performance of the proposed sensor has been established corresponding to four different types of volatile liquids having different refractive indices in the context of AuNPs and AgNPs.
- By utilizing these aforementioned novel features, the proposed sensing set-up can be implemented in designing more cost-effective gas sensors.

Abstract:

In the present paper a fiber-optic volatile liquid sensor based on localized surface plasmon resonance (LSPR) has been demonstrated. The sensing probe element has been realized through deposition of colloidal nanoparticle layer on the unclad U-bent portion of a multimode fiber. Evanescent field at the sensing region excites the localized surface plasmons (LSPs) of noble metal nanoparticles (Ag and Au) of average diameter 20 nm. The electric field of the plasmons interacts with the vapors of volatile liquids (such as acetone, methanol, ethanol and propanol) at different concentration causing a progressive change in resonance conditions of the localized plasmons which eventually modulate the output light signal of the fiber. The modulated light signal at the output end of the fiber falls on a photo-detector and consequently the detector registers a change in voltage response. The consistency of the designed optical sensor has been investigated using both Ag and Au nanoparticle coating on the unclad portion of the fiber. The response sensitivity for Ag nanoparticle coated probe is found to be more uniform than that of Au nanoparticles coated probe. The sensor shows quick response towards vapors of volatile liquids and requires very small amount of