

Highly sensitive fiber-optic VOC gas sensor to detect low concentration of benzene

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Volatile organic compounds (VOCs), famous as air pollution sources, are a group of chemical compounds that easily evaporate at room temperature and some of which may have short- and long-term adverse health effects. Furthermore, the importance of detecting the presence of VOCs in indoor air goes beyond health concerns. In our study, we designed and developed a fiber-optic evanescent field absorption VOC gas sensor that can detect low concentration benzene 1 to 10 ppb. The operation principle of the sensor is based on wavelength shift modulation. The proposed gas sensor was prepared by incorporating a well-known solvatochromic dye namely Nile red into polyvinylpyrrolidone (PVP) and using it as a sensing membrane on a side-polished single-mode optical-fiber. The optical properties of the Nile red containing sensing membrane change as it absorbs the VOC gas like benzene. This sensing film produces strong signals, fast and reversible when it is exposed to polar gases. An optical spectrometer (QE6500, Ocean Optics) was used to observe the performance of the sensor. The sensitivity of the proposed fiber-optic VOC sensor for benzene gas was approximately 0.7633 nm/ppb with short response and recovery times which were less than 60s. The obtained data confirmed our experimental investigation..

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