Sensing performance of modified single mode optical fiber coated with nanomaterials based ammonia sensors operated in the C-band

ABSTRACT

An etched tapered single mode optical fiber (SMF) coated with polyaniline (PANI) nanofibers is developed to detect ammonia (NH3) in low concentrations. The SMF is etched with hydrofluoric acid (HF) and subsequently tapered using a glass processing workstation. The etched tapered SMF is coated with PANI via spray-coating deposition. This SMF modification significantly enhances the interaction of the evanescent field of the light propagating in the core with the PANI-sensing layer. The modified fiber sensor response is investigated by exposing the sensor to different concentrations of NH3 over the C-band wavelengths of 1535–1565 nm. Integrating the modified optical fiber with the nanostructured PANI films produces highly sensitive optical sensor that operates at room temperature. The 50 μm etched tapered SMF coated with PANI produced response, recovery times, and sensitivity of 58 s, 475 s, and 231.5%, respectively, in the C-band range. The limit of detection of the modified fiber sensor was 0.0025%, which is equal to 25 ppm. The developed sensor exhibits good repeatability, reversibility, and selectivity.

Keyword: Ammonia sensors; Modified SMF sensors; Etched-tapered optical fiber;Polyaniline nanofiber; C-band sensors