Surface Modification of Montmorillonite Clay by Benzenediazonium Cation: Ammonia Gas Sensor

06 Nov.
NSM57

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Ammonia is produced in various chemical industries and intensive livestock farming. Exposure to high levels of ammonia brings health issues in humans, and therefore, development of sensitive platforms for sensing ammonia at room temperature has received significant attention. In this study, a sensitive and highly selective benzene diazoniumchloride intercalated montmorillonite clay (BDC-MMT) based sensor was developed. Intercalation of benzene diazoniumchloride was accomplished by allowing aniline to get adsorbed onto clay and dropwise addition of 0.1 mol dm^{-3} $NaNO_2$ for a period of one hour at 5 ^0C. Formation of benzene diazonium cation was confirmed by the Fourier-transform infrared spectroscopy characteristic peaks at around 1513 cm^{-1} and 1456 cm^{-1} for the presence of NO group and -N=N- group respectively. UV-Vis spectral analysis of BDC-MMT thin film showed a characteristic absorption band at 492 nm due to conjugated structure formed by azo bond. Exposure of BDC-MMT to dry ammonia gas changed the original reddish-brown colour to yellow colour. Experiments continued with sulphur dioxide, hydrogen sulphide, and formaldehyde vapour showed no detectable change in colour or UV-visible spectral data. This suggests the applicability of BDC-MMT sensor for detection of ammonia gas.

Keywords: Montmorillonite, diazoniumchloride, ammonia, sensor, selectivity