Dependence of the optical constant parameters of p-toluene sulfonic acid-doped polyaniline and its composites on dispersion solvents

ABSTRACT

The optical constants of Para-Toluene sulfonic acid-doped polyaniline (PANI), PANIchitosan composites, PANI-reduced graphene-oxide composites and a ternary composite comprising of PANI, chitosan and reduced graphene-oxide dispersed in diluted p-toluene sulfonic acid (PTSA) solution and N-Methyl-2-Pyrrolidone (NMP) solvent have been evaluated and compared. The optical constant values were extracted from the absorbance spectra of thin layers of the respective samples. The potential utilization of the materials as the active sensing materials of surface plasmon resonance biosensors has also been assessed in terms of the estimated value of the penetration depth through a dielectric medium. The results show a reasonable dependence of the optical constant parameters on the solvent type. Higher real part refractive index (n) and real part complex dielectric permittivity (ε') values were observed for the samples prepared using PTSA solution, while higher optical conductivity values were observed for the NMP-based samples due to their relatively higher imaginary part refractive index (k) and imaginary part complex dielectric permittivity (ε″) values. In addition, NMP-based samples show improvement in terms of the penetration depth through a dielectric medium by around 9.5, 1.6, 4.4 and 2.9 times compared to PTSA-based samples for the PANI, PANI-chitosan, PANI-RGO and the ternary composites, respectively. Based on these, it is concluded that preparation of these materials using different dispersion solvents could produce materials of different optical properties. Thus, the variation of the dispersion solvent will allow the flexible utilization of the PANI and the composites for diverse applications.

Keyword: p-toluene sulfonic acid-doped polyaniline; Optical constant parameters; Chitosan; Reduced graphene-oxide; Surface plasmon resonance (SPR)