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Simultaneous use of dopant combination during synthesis of polyaniline: An approach towards synergistic improvement in different properties

Subhendu Bhandari^{1,2} and Dipak Khashtgir²¹Maharashtra Institute of Technology, India²Indian Institute of Technology Kharagpur, India

Polyaniline (PANI) is one of the most widely explored intrinsically conducting polymers which is conducting in nature in its partially doped form. The present investigation reveals the synergistic effect of simultaneous use of dopant combinations during synthesis of PANI on its different properties. Individually and dual doped PANI were synthesized via electrochemical and solid state route. Electrochemical synthesis was carried out in polar protic (aqueous) as well as aprotic (dimethyl formamide) solvent using sulfuric acid (H_2SO_4) and p-toluenesulfonic acid (PTSA) as dopants. Solvent-free solid state synthesis of PANI involved the dopants citric acid monohydrate (CA) and camphorsulfonic acid (CSA). For all cases total dopant concentration was maintained at 1M and relative proportion of the dopant concentrations was varied at 1:3, 2:2 and 3:1. Simultaneously dual doped PANI exhibited synergistic improvement in electrical conductivity for all cases. Dopant ratios of $[H_2SO_4]:[PTSA]=3:1$ and $[CA]:[CSA]=3:1$ resulted in highest extent of synergy for respective synthesis processes. Dopant combination of H_2SO_4 and PTSA in protic and aprotic polar medium of synthesis exhibited maximum improvement of conductivity by 1.5 and 2.6 fold increase. However, the combination of CA and CSA in solid state synthesis exhibited a maximum of 8 fold increase of conductivity compared to individually doped samples which is even higher in comparison with 4% (w/w) addition of multiwalled carbon nanotube in CA doped PANI. Synergistic improvement was also observed for different dual doped PANI in supercapacitive behaviour as well as thermal degradation characteristics within certain range of temperature.

Biography

Subhendu Bhandari has completed his PhD from Indian Institute of Technology Kharagpur, India. At present, he is an Assistant Professor in Plastics and Polymer Engineering Department, Maharashtra Institute of Technology, Aurangabad. He has published 9 papers in reputed journals and filed 1 patent.

subhenduonly@gmail.com

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