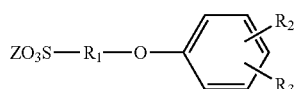


[0069] In accordance with still another aspect of the present disclosure, there is provided a dopant including the organic sulfonic acid-based compound represented by Chemical Formula 1 in accordance with the present disclosure.

[0070] The dopant including the organic sulfonic acid-based compound of the present disclosure is provided to solve a problem of a conventional dopant of a conductive polymer. The conventional dopant disappears by thermal diffusion or sublimation, and during a process, if time passes at a high temperature, conductivity is sharply decreased or compatibility with respect to a conductive polymer is low, so that electrical conductivity and a mechanical property cannot be improved. Thus, there is provided a dopant in which a sulfonic acid is flexibly bonded to an aryl group such as a benzene ring. In the present disclosure, the reason why the dopant having a flexible bond is prepared is to provide protons while maintaining stacking between an aryl ring such as a benzene ring of a dopant and an aromatic ring of a conductive polymer or a hydrogen bond with a substituent, and a structure of a mesophase, i.e. to effectively perform doping. To be specific, the dopant in accordance with the present disclosure induces a molecular interaction with a conductive polymer, thereby giving a heat-resistance, an environment-resistance, and surface activity. Based on them, a conductive polymer composite having excellent electrical, optical, and mechanical properties can be provided.

[0071] In an illustrative embodiment, the organic sulfonic acid-based compound may include a mixture of the organic sulfonic acid with a metallic salt of the organic sulfonic acid, but the present disclosure may not be limited thereto.

[0072] In an illustrative embodiment, the organic sulfonic acid-based compound may be represented by the following Chemical Formula 2, and the dopant may include a mixture of the organic sulfonic acid where Z of Chemical Formula 2 is —H with a metallic salt of the organic sulfonic acid where Z is a metal cation M^+ , but may not be limited thereto:



[Chemical Formula 2]

[0073] wherein in Chemical Formula 2, R_1 , R_2 , R_3 , and Z are the same as defined above.

[0074] In Chemical Formula 1 or 2 representing the organic sulfonic acid-based compound in accordance with the present disclosure, a function of the compound as a dopant to be added to a conductive polymer or the like can be changed depending on a type of R_1 , R_2 , and R_3 . Since compatibility between a polymer to be added and/or a solvent may vary depending on a pH according to a relative ratio of the sulfonic acid and its metallic salt, regulating these factors may be very important in use of the compound as a dopant, a function of the compound as a surfactant, and regulation of properties.

[0075] By way of example, if the organic sulfonic acid-based compound of the present disclosure has a metallic salt form, its conjugate base is very important in use of the compound as a dopant. By way of example, the conjugate base may improve solubility and may give surface activity to a composite system with a conductive polymer, and the conjugate base may have a mesophase structure so as to change a shape of a conductive polymer.

[0076] In an illustrative embodiment, the dopant may further include an auxiliary dopant selected from the group consisting of camphorsulfonic acid (CSA), dodecylbenzene sulfonic acid (DBSA), acrylamidomethyl sulfonic acid (AMPSA), p-toluene sulfonic acid (PTSA), and combinations thereof, but the present disclosure may not be limited thereto.

[0077] In accordance with still another aspect of the present disclosure, there is provided a conductive polymer composite including: a conductive polymer; and a dopant containing an organic sulfonic acid-based compound in accordance with the present disclosure.

[0078] In an illustrative embodiment, the conductive polymer may include a member selected from the group consisting of a polyaniline, a polythiophene, a polypyrrole, a poly-paraphenylene vinylene, a polyazine, a poly-p-phenylene sulfide, a polyfurane, a polyacetylene, a polyselenophene, and combinations thereof which may have a substituent, but the present disclosure may not be limited thereto.

[0079] In an illustrative embodiment, the conductive polymer may include a member selected from the group consisting of a polyaniline, a polypyrrole, a polythiophene, and combinations thereof which may have a substituent, but the present disclosure may not be limited thereto.

[0080] In an illustrative embodiment, the conductive polymer may include an emeraldine salt (ES) of a polyaniline, but the present disclosure may not be limited thereto.

[0081] In an illustrative embodiment, the conductive polymer may include a polymer blend obtained by mixing an emeraldine salt (ES) of a polyaniline with a second polymer, but the present disclosure may not be limited thereto.

[0082] In an illustrative embodiment, the second polymer may include a member selected from the group consisting of a polyethylene, a polypropylene, a polyester, a polyamide, a polyether, a polycarbonate, a polyvinyl acetate, a polyvinylidene fluoride, a polymethylmetacrylate, a polystyrene, a polyvinylchloride, a polyurethane, a polysulfone, a polyethersulfone, a polyether ether ketone (PEEK), a polyimide, an epoxy resin, a polyacrylonitrile, a polyphosphazene, a nitrile butadiene rubber (NBR), a polysiloxane, and combinations thereof, but the present disclosure may not be limited thereto.

[0083] In an illustrative embodiment, the conductive polymer composite may have electrical conductivity in a range of from about 10^{-9} S/cm to about 10^3 S/cm, but the present disclosure may not be limited thereto.

[0084] In an illustrative embodiment, the conductive polymer may be in the form of a film, a fiber, a particle or a liquid, but the present disclosure may not be limited thereto.

[0085] In accordance with still another aspect of the present disclosure, there is provided a preparing method of a conductive polymer composite, the method including: doping a conductive polymer by adding a solution containing the dopant for a conductive polymer containing the organic sulfonic acid-based compound of the present disclosure.

[0086] In an illustrative embodiment, the conductive polymer may be in the form of a solution, a film, a fiber, or a particle, but the present disclosure may not be limited thereto.

[0087] In an illustrative embodiment, the preparing method of a conductive polymer composite in accordance with the present disclosure may further include: processing the doped conductive polymer to be in the form of a film, a fiber, or a particle, but the present disclosure may not be limited thereto.