prevent from liquid electrolytes leaking. The well mechanical strength will make the electrolyte membranes possess certain character of manufacturing process. Moreover, The superior compatible to an electrode leads to simplify package process, reduce product cost of batteries, and cause flexibility of batteries design. Most prior batteries just include either one or two items of those properties, and hardly possess all of them. However, this present invention possesses all properties mentioned above, and has advantages of easy manufacturing processes, simple package system, and flexible designs.

[0038] The solid polymer electrolytes generally consist of polyalkylene oxide, (i.e., PEO, PPO, etc.), and all kinds of alkaline metallic salts (D. E. Fenton, J. M. Parker, P. V. Wright, Polymer, 14, 589, 1973; P. V. Wright, Br. Polymer. J. 7, 319, 1975). The structure of pure PEO polymers is regular and helix and its crystal degree is 66%. And when formed coordination compounds with alkaline metallic salts, the crystal degree will arise to 70%. The conductivity of conductive solid polymer electrolytes is corresponding to the cationic movement in the uncrystal region of polymer. The cation ion can interact with several oxygen ion of EO chain (i.e., —CH_2CH_2O—), and move through by chain wriggle, thus the solid polymer electrolytes possesses conductivity property (G. Perterson, P. Jacobsson, L. M. Torell, Electrochim. Acta, 37, 1495,1992). However, the conductivity of solid polymer electrolytes is low, only at 10^{-8} S/cm, and will increasingly reach to the value similar to organic electrolytes at 10^{-3} S/cm only at 100° C., that can account for no application sample in fact. Since movement of ion in the uncrystal region of polymer causing the conductive property, the reduction of crystal degree of polymer is the critical point.

[0039] The gel-type polymer electrolytes have higher conductivity than that of solid polymer electrolytes because of absorbing liquid electrolytes via polymer, moreover, that make soften gel-type polymer electrolytes have superior compatible to positive and negative electrodes and lower interface resistance compared to hard solid polymer electrolytes. However, absorbing liquid electrolytes of gel-type polymer electrolytes also caused reduction of size stability and mechanical strength, and under high temperature and pressure condition, the gel-type polymer electrolytes will be soft easily and may cause current short of batteries.

[0040] The PAN system of gel-type electrolytes is the one of the field of the gel-type electrolytes that has been widely researched. Since PAN polymers enough with polarity, possess well compatible to noaqueous solvent electrolytes that are generally high polarity, and thus its conductivity is relatively high. The common process of PAN system electrolytes is that dissolves the PAN polymers (molecular weight is 10,000-1,000,000) in the excess liquid electrolytes, well stir after adding some extra components, and form the liquid phase as membrane at high temperature. After cooling, the PAN polymer membranes will be in form of the gel type. According to those gel-type electrolytes will deform under high temperature and extra force for long time, they remain safety problem when used that as a separator of batteries.

[0041] In the view of polymer batteries, both of the solid and gel-type polymer electrolytes have advantages and disadvantages in the conductivity and the mechanical strength simultaneously. These are the criteria between the conductivity and the mechanical strength. If the main chains of polymers possess major structures of both solid and gel-type polymers simultaneously, that will qualify for the properties of superior mechanical strength and high conductivity.

[0042] The present invention, composite gel-type polymer electrolytes possess superior mechanical strength and high conductivity, thereby, it can be used in the batteries industries which require the thin size, the large electric capacity, and the high energy density output, in particularly, are the gel-type polymer electrolytes of the lithium polymer secondary batteries.

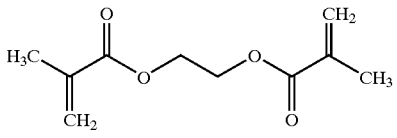
[0043] The present invention, composite gel-type polymer electrolytes mainly consist of polymers with crosslinked structure and nonaqueous electrolytes.

[0044] The manufacturing process of polymers with crosslinked structure is that mixes monomers with crosslinked monomer reagent, adds the peroxides as the initial agent, and then copolymerizes them by heating or light inducing. The polymers with chemically crosslinked structures have higher temperature stability and mechanical strength than the ones without.

[0045] To mix another crosslinked polymers, (i.e., PVdF, PEO, PS, etc.) to the mixture of monomers and crosslinked monomer reagent that were mentioned above, and through copolymerizing and forming as membranes, eventually, the product possesses interpenetrating network structures. The means of combining with different polymer can lead to increase the mechanical strength of composite polymers.

[0046] The crosslinked monomer reagent that was used in this present invention has double chains in the terminal portion and —CH_2CH_2— chain in the middle portion, for examples: ethylene glycol dimethacrylate (EGD), is represented by Formula II; or triethylene glycol dimethacrylate (TGD), is represented by Formula III. Selecting the crosslinked monomer reagent with the EO chain in the middle portion is because that the unpair electrons located on oxygen atom is able to form coordination bond with oxygen ion, and result in high dissociation of positive and negative ion of alkaline metal group.

(II)



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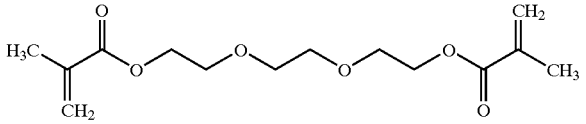

[0047] The nonaqueous liquid electrolytes consisting of organically nonaqueous solvent and metallic salts can be a function as plasticizers. The organically nonaqueous solvents are the organic solvent with high electric permittivity and dipole moment enough to dissociate salts, that are cyclic