CLAIMS

WHAT IS CLAIMED IS:

1. A coated separator, comprising a coating layer formed by a coating slurry, the coating slurry comprising an organic polymer, a solvent, and a photoinitiator, wherein the photoinitiator is added at an amount of 0.001 wt% to 5 wt%;

wherein the coating layer comprises a three-dimensional (3D) network structure formed through interconnection of organic polymer molecules, and a mass of the 3D network structure is 50% or more of a total mass of the organic polymer and is 1.0% or more of a total mass of the coating layer.

2. The coated separator according to claim 1, wherein the organic polymer is added at an amount of 0.05 wt% to 50 wt%; and the organic polymer is selected from at least one of a polyvinylidene fluoride (PVDF) homopolymer, poly(vinylidene fluoride-co-hexafluoropropylene) (PVDF-HFP), poly(vinylidene fluoride-co-trichloroethylene) (PVDF-TCE), polyacrylonitrile (PAN), polymethacrylate (PMA) or a derivative thereof, polyacrylamide (PAM), a polyimide (PI), polyethylene oxide (PEO), and cellulose.

3. The coated separator according to claim 1 or 2, wherein the photoinitiator is selected from one or a combination of at least two of azodiisobutyronitrile (AIBN), xanthone (XAN), isopropylthioxanthone (ITX), benzophenone (BP), and benzoyl peroxide (BPO).

4. The coated separator according to claim 1, wherein the solvent is selected from at least one of *N*,*N*-dimethylformamide (DMF), *N*,*N*-dimethylacetamide (DMAc), dichloroethane (DCE), trichloroethane (TCE), dichloromethane (DCM), chloroform, dimethyl sulfoxide (DMSO), sulfolane, tetramethylurea (TMU), N-methylpyrrolidone (NMP), acetone, water, trimethyl phosphate (TMP), or triethyl phosphate (TEP).

5. The coated separator according to claim 1, further comprising an inorganic material, wherein a mass proportion of the inorganic material in the coating slurry is 50 wt% to 95 wt%.

6. The coated separator according to claim 5, wherein the inorganic material is selected from a ceramic material, a nanowire material, or a nanotube material;

the ceramic material is selected from one or a combination of at least two of Al_2O_3, SiO_2, TiO_2, ZrO_2, MgO, CaO, AlOOH, and SiC;

the nanowire material is selected from at least one of a carbon nanowire, attapulgite, a silver nanowire, a boron carbide nanowire, nanocellulose, a copper hydroxide nanowire, a silicon monoxide nanowire, and a hydroxyapatite nanowire; and

the nanotube material is selected from at least one of a carbon nanotube (CNT), a silver nanotube, a boron carbide nanotube, a copper hydroxide nanotube, a silicon monoxide nanotube, and a hydroxyapatite nanotube.

7. The coated separator according to any one of claims 1 to 6, further comprising a substrate, wherein the coating slurry is coated on at least one surface of the substrate and irradiated under ultraviolet (UV) light with a set energy and wavelength to allow UV crosslinking to obtain the coated separator.

8. The coated separator according to claim 7, wherein the substrate is selected from at least one of a polyolefin (PO) microporous membrane, a PI microporous membrane, a non-woven membrane, a multi-layer composite membrane, a ceramic-coated membrane, and a polymer-coated membrane.

9. A preparation method of the coated separator according to any one of claims 1 to 8, comprising the following steps:

(1) preparation of the coating slurry: adding no more than 50 wt% of the organic polymer, 0.001 wt% to 5.0 wt% of the photoinitiator, 50 wt% to 95 wt% of an inorganic material, and 0 wt% to 5 wt% of other additives to the solvent to obtain a resulting mixture, and thoroughly stirring the resulting mixture to obtain the coating slurry;

(2) coating: coating the coating slurry on at least one surface of a substrate to obtain a first coated substrate;

(3) phase transformation: subjecting the first coated substrate to the phase transformation to obtain a second coated substrate;

(4) drying: rinsing and drying the second coated substrate obtained in the step (3) to obtain a composite separator; and

(5) UV crosslinking: irradiating the composite separator under UV light to initiate a crosslinking reaction to obtain a UV-crosslinked composite separator.

10. The preparation method of the coated separator according to claim 9, wherein the UV light has a wavelength of 210 nm to 420 nm and an intensity of 50 mj/cm^2 or more, and the UV crosslinking is conducted for 0.001 s to 10 s.