CLAIMS

1. A battery separator, comprising a substrate, wherein a polymer layer is coated on one side or two sides of the substrate, and the polymer layer is formed by mixing a first polymer, a second polymer, a first ceramic particle, and a second ceramic particle, wherein particle sizes of the first ceramic particle and the second ceramic particle are 0.01μm-1μm, and a specific surface area of the first ceramic particle is ≥50 m^2/g.

2. The battery separator according to claim 1, wherein a particle size of the first ceramic particle is 0.01-0.3 μm.

3. The battery separator according to claim 1, wherein a particle size of the second ceramic particle is 0.3-1 μm, and a particle size of the first ceramic particle is smaller than a particle size of the second ceramic particle.

4. The battery separator according to claim 1, wherein a mass-percentage ratio of the first ceramic particle to the second ceramic particle is: 10%-50%: 50%-90%.

5. The battery separator according to claim 4, wherein the mass-percentage ratio of the first ceramic particle to the second ceramic particle is: 10%-35%: 65%-90%.

6. The battery separator according to any one of claims 1-5, wherein the first polymer is a high-adhesive polymer resin, and the high-adhesive polymer resin is a binder resin, wherein a dry-press adhesive force of the battery separator is ≥20N/m, and a wet-press adhesive force of the battery separator is ≥8N/m.

7. The battery separator according to claim 6, wherein the high-adhesive polymer resin comprises a copolymer of polyvinylidene difluoride and hexafluoropropylene, sodium carboxymethyl cellulose, and a polymethacrylate polymer.

8. The battery separator according to claim 7, wherein in the copolymer of polyvinylidene difluoride and hexafluoropropylene, a mass percentage of the hexafluoropropylene in the copolymer is 4% to 20%; a molecular weight of the copolymer of polyvinylidene difluoride and hexafluoropropylene is 300,000 to 500,000; a melting point of the copolymer of polyvinylidene

difluoride and hexafluoropropylene is 125~150°C; and a melt viscosity of the copolymer of polyvinylidene difluoride and hexafluoropropylene is 15~35 cps.

9. The battery separator according to claim 1, wherein the second polymer is a heat-resistant polymer resin having a melting point larger than or equal to 180°C.

10. The battery separator according to claim 9, wherein the heat-resistant polymer resin comprises one or two of polyetherimide, polyimide, polyvinylidene fluoride-tetrafluoroethylene-propylene terpolymer, and polyvinylidene difluoride-trifluoroethylene-chlorotrifluoroethylene terpolymer.

11. The battery separator according to claim 1, wherein a mass-percentage ratio of the first polymer to the second polymer is: 10~40%: 60~90%.

12. The battery separator according to claim 1, wherein based on a mass sum of the first polymer, the second polymer, the first ceramic particle, and the second ceramic particle in the polymer layer, a mass percentage of a sum of the first ceramic particle and the second ceramic particle in the polymer layer is 30% to 70%.

13. The battery separator according to claim 1, wherein the polymer layer comprises a ceramic particle, wherein raised island structures are formed on a surface of the polymer layer.

14. The battery separator according to claim 13, wherein a diameter of the island structures is 0.8-2 μm.

15. A preparation method of a battery separator for preparing the battery separator according to any one of claims 1-14, comprising:

selecting the first polymer and the second polymer, and dissolving a mixture of the first polymer and the second polymer in a first solvent to obtain a premixed slurry A;

screening the first ceramic particle and the second ceramic particle, wherein the particle sizes of the first ceramic particle and the second ceramic particle are 0.01μm-1μm, and the specific surface area of the first ceramic particle is ≥50 m^2/g;

adding two types of the ceramic particles of different particle sizes simultaneously or successively to the premixed slurry A and mixing, so as to obtain the polymer-layer coating slurry; and

coating the polymer-layer coating slurry on one side or two sides of the substrate, so as to obtain the battery separator.

16. The preparation method of a battery separator for preparing the battery separator according to claim 15, wherein after coating the polymer-layer coating slurry on one side or two sides of the substrate, the method further comprises conveying the coated substrate into a coagulating bath containing a coagulating solution consisting of a second solvent or a mixture of the second solvent with the same solvent as said first solvent and then drying it.

17. The preparation method of a battery separator for preparing the battery separator according to claim 16, wherein the first solvent includes at least one of acetone, dichloromethane, benzene, toluene, xylene, dimethylformamide, dimethylsulfoxide, trimethyl phosphate, cyclohexane, cyclohexanone, toluene cyclohexanone, chlorobenzene, dichlorobenzene, dichloromethane, ethyl ether, propylene oxide, methylethyl ketone, methylbutyl ketone, methylisobutyl ketone, ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, ethylene glycol monobutyl ether, tetrahydrofuran, trichloromethane, and N-methyl-2-pyrrolidinone; and the second solvent includes at least one of ethanol, water, glycerol, ethyl acetate, and polyethylene glycol.

18. A battery, comprising a battery separator, a positive electrode, a negative electrode, and an electrolyte, wherein the battery separator is the battery separator according to any one of claims 1-14.

19. The battery according to claim 18, wherein a particle size of the first ceramic particle is 0.01-0.3 μm; a particle size of the second ceramic particle is 0.3-1 μm, and a particle size of the first ceramic particle is smaller than a particle size of the second ceramic particle.

20. The battery according to claim 19, wherein a mass-percentage ratio of the first ceramic particle to the second ceramic particle is: 10%-35%: 65%-90%.