CLAIMS

1. An article comprising a material and a coating, wherein the material comprises a fiber, a thread, a yarn, or leather, and wherein the coating comprises:

silk fibroin proteins or fragments thereof having an average weight average molecular weight range of 5 kDa to 144 kDa and a polydispersity ranging from 1.0 to 5.0; and

a chemical agent.

2. The article of claim 1, wherein the silk proteins or fragments thereof comprise low molecular weight silk fibroin, medium molecular weight silk fibroin, high molecular weight silk fibroin, or a combination thereof.

3. The article of claim 1, wherein the silk based proteins or fragments thereof have an average weight average molecular weight range selected from the group consisting of 5 to 10 kDa, 6 kDa to 16 kDa, 17 kDa to 38 kDa, 39 kDa to 80 kDa, 60 to 100 kDa, and 80 kDa to 144 kDa.

4. The article of claim 1, wherein the the chemical agent is selected from the group consisting of an antimicrobial agent, an antifungal agent, a softener, a water repellant agent, an oil repellant agent, a dye, a flame retardant, a fabric softener, a pH adjusting agent, an anticrocking agent, an antipilling agent, an antifelting agent, and combinations thereof.

5. The article of any one of claims 1 to 4, wherein the chemical agent comprises a silicone.

6. The article of any one of claims 1 to 5, wherein the material comprises a fabric, a textile, a woven material, a non-woven material, a knit material, a crochet material, a natural leather, a synthetic leather, or a combination thereof.

7. The article of any one of claims 1 to 6, wherein the material comprises one or more of polyester, polyamide, polyaramid, polytetrafluorethylene, polyethylene, polypropylene, polyurethane, silicone, mixtures of polyurethane and polyethyleneglycol, ultrahigh molecular weight polyethylene, high-performance polyethylene, nylon, polyester-polyurethane copolymer, LYCRA, cotton, alpaca fleece, alpaca wool, lama fleece, lama wool, cashmere, sheep fleece, sheep wool, tanned leather, chamois leather, patent leather, vachetta leather, nubuck leather, rawhide leather, split leather, full-grain leather, top-grain leather, corrected-grain leather, poromeric imitation leather, vinyl and/or polyamide felt fibers, polyurethane synthetic leather, polyvinyl chloride synthetic leather, polyethylene leather, polypropylene leather, vinyl acetate copolymer synthetic leather, polyamide synthetic leather, polyester synthetic leather, textile-polymer composite microfibers, corfan leather, koskin leather, or leatherette.

8. The article of any one of claims 1 to 7, wherein the coating has been applied at the fiber, thread, or yarn level.

9. The article of any one of claims 1 to 8, wherein the coating has been applied at the fabric, woven material, non-woven material, knit material, crochet material, natural leather, or synthetic leather level.

10. A method of coating a material with a composition comprising silk based proteins or fragments thereof to provide a silk fibroin coated material, the method comprising:

coating a surface of the material with a silk fibroin solution comprising silk fibroin proteins or fragments thereof having an average weight average molecular weight range of 5 kDa to 144 kDa and a polydispersity ranging from 1.0 to 5.0;

coating a surface of the material with a chemical agent; and

drying the surface of the material that has been coated with the silk fibroin solution to provide the silk fibroin coated material.

11. The method of claim 10, wherein the silk fibroin solution comprises a concentration of one or more of low molecular weight silk fibroin, medium molecular weight silk fibroin, high molecular weight silk fibroin, or a combination thereof.

12. The method of claim 10, wherein the silk fibroin solution comprises silk fibroin based proteins or fragments thereof having an average weight average molecular weight range selected from the group consisting of 5 to 10 kDa, 6 kDa to 16 kDa, 17 kDa to 38 kDa, 39 kDa to 80 kDa, 60 to 100 kDa, and 80 kDa to 144 kDa.

13. The method of any one of claims 10 to 12, wherein drying the surface of the material comprises heating the surface of the material without substantially modifying silk fibroin coating performance.

14. The method of claim 10, wherein the chemical agent is added to the silk fibroin solution, or provided in a separate coating step before or after the silk fibroin solution coating step.

15. The method of any one of claims 10 to 14, wherein the chemical agent is selected from the group consisting of an antimicrobial agent, an antifungal agent, a softener, a water repellant agent, an oil repellant agent, a dye, a flame retardant, a fabric softener, a pH adjusting agent, an anticrocking agent, an antipilling agent, an antifelting agent, and combinations thereof.

16. The method of any one of claims 10 to 15, wherein the chemical agent comprises a silicone.

17. The method of any one of claims 10 to 16, wherein the silk fibroin solution further comprises a Bronsted acid.

18. The method of any one of claims 10 to 17, wherein the material comprises one or more of a fiber, a thread, a yarn, a fabric, a textile, a woven material, a non-woven material, a knit material, a crochet material, a natural leather, or a synthetic leather.

19. The method of any one of claims 10 to 18, wherein the material comprises one or more of polyester, polyamide, polyaramid, polytetrafluorethylene, polyethylene, polypropylene, polyurethane, silicone, mixtures of polyurethane and polyethyleneglycol, ultrahigh molecular weight polyethylene, high-performance polyethylene, nylon, polyester-polyurethane copolymer, LYCRA, cotton, alpaca fleece, alpaca wool, lama fleece, lama wool, cashmere, sheep fleece, sheep wool, tanned leather, chamois leather, patent leather, vachetta leather, nubuck leather, rawhide leather, split leather, full-grain leather, top-grain leather, corrected-grain leather, poromeric imitation leather, vinyl and/or polyamide felt fibers, polyurethane synthetic leather, polyvinyl chloride synthetic leather, polyethylene leather, polypropylene leather, vinyl acetate copolymer synthetic leather, polyamide synthetic leather, polyester synthetic leather, textile-polymer composite microfibers, corfan leather, koskin leather, or leatherette.

20. The method of any one of claims 10 to 19, wherein the chemical agent is selected to improve one or more of a first selected property, a second selected property, or a third selected property of the material, wherein:

the first selected property comprises one or more of an antimicrobial property, a water repellant property, an oil repellant property, a flame retardant property, a coloring property, a fabric softening property, a stain repellant property, a pH adjusting property, an anticrocking property, an antipilling property, and an antifelting property;

the second selected property comprises one or more of wetting time, absorption rate, spreading speed, accumulative one-way transport, and overall moisture management capability; and

the third selected property comprises one or more of fabric hand, fabric stretch, and drapability.

21. The method of claim 20, wherein the improved one or more of a first selected property, a second selected property, or a third selected property of the material is determined after a number of machine washing cycles selected from the group consisting of about 5 cycles, about 10 cycles, about 25 cycles, and about 50 cycles.