CLAIMS

1. An article comprising a leather substrate and silk fibroin proteins or fragments thereof having an average weight average molecular weight in a range selected from between about 1 kDa and about 5 kDa, between about 5 kDa and about 10 kDa, between about 6 kDa and about 17 kDa, between about 10 kDa and about 15 kDa, between about 15 kDa and about 20 kDa, between about 17 kDa and about 39 kDa, between about 20 kDa and about 25 kDa, between about 25 kDa and about 30 kDa, between about 30 kDa and about 35 kDa, between about 35 kDa and about 40 kDa, between about 39 kDa and about 80 kDa, between about 40 kDa and about 45 kDa, between about 45 kDa and about 50 kDa, between about 60 kDa and about 100 kDa, and between about 80 kDa and about 144 kDa, and a polydispersity between 1 and about 5.

2. The article of claim 1, wherein the silk fibroin proteins or fragments thereof have a polydispersity between 1 and about 1.5, between about 1.5 and about 2, between about 2 and about 2.5, between about 2.5 and about 3, between about 3 and about 3.5, between about 3.5 and about 4, between about 4 and about 4.5, or between about 4.5 and about 5.

3. The article of claim 1 or 2, further comprising about 0.001% (w/w) to about 10% (w/w) sericin relative to the silk fibroin proteins or fragments thereof.

4. The article of any one of claims 1 to 3, wherein a portion of the silk fibroin proteins or fragments thereof is coated on a surface of the leather substrate.

5. The article of any one of claims 1 to 4, wherein a portion of the silk fibroin proteins or fragments thereof is infused into a layer of the leather substrate.

6. The article of any one of claims 1 to 5, wherein a portion of the silk fibroin proteins or fragments thereof is in a recessed portion.

7. The article of any one of claims 1 to 6, the article further comprising one or more polysaccharides selected from starch, cellulose, gum arabic, guar gum, xanthan gum, alginate, pectin, chitin, chitosan, carrageenan, inulin, and gellan gum.

8. The article of any one of claims 1 to 7, the article further comprising one or more polyols, and/or one or more polyethers, and/or one or more of a silicone, a dye, a pigment, and a polyurethane.

9. The article of claim 8, wherein the polyols comprise one or more of glycol, glycerol, sorbitol, glucose, sucrose, and dextrose, and the polyethers comprise one or more polyethyleneglycols (PEGs).

10. A method of treating a leather substrate with a silk formulation, the method comprising applying on a surface of the leather a silk formulation comprising silk fibroin proteins or fragments thereof having an average weight average molecular weight in a range selected from between about 1 kDa and about 5 kDa, between about 5 kDa and about 10 kDa, between about 6 kDa and about 17 kDa, between about 10 kDa and about 15 kDa, between about 15 kDa and about 20 kDa, between about 17 kDa and about 39 kDa, between about 20 kDa and about 25 kDa, between about 25 kDa and about 30 kDa, between about 30 kDa and about 35 kDa, between about 35 kDa and about 40 kDa, between about 39 kDa and about 80 kDa, between about 40 kDa and about 45 kDa, between about 45 kDa and about 50 kDa, between about 60 kDa and about 100 kDa, and between about 80 kDa and about 144 kDa, and a polydispersity between 1 and about 5.

11. The method of claim 10, wherein the silk fibroin proteins or fragments thereof have a polydispersity between 1 and about 1.5, between about 1.5 and about 2, between about 2 and about 2.5, between about 2.5 and about 3, between about 3 and about 3.5, between about 3.5 and about 4, between about 4 and about 4.5, or between about 4.5 and about 5.

12. The method of claim 10 or 11, wherein the silk formulation further comprises about 0.001% (w/w) to about 10% (w/w) sericin relative to the silk fibroin

proteins or fragments thereof, or wherein the silk formulation further comprises about 0.001% (w/v) to about 10% (w/v) sericin.

13. The method of any one of claims 10 to 12, wherein a portion of the silk formulation is coated on a surface of the leather substrate.

14. The method of any one of claims 10 to 13, wherein a portion of the silk formulation is infused into a layer of the leather substrate.

15. The method of any one of claims 10 to 14, wherein a portion of the silk formulation enters a recessed portion of the leather substrate.

16. The method of any one of claims 10 to 15, wherein the silk formulation further comprises a rheology modifier.

17. The method of claim 16, wherein the rheology modifier comprises one or more polysaccharides selected from starch, cellulose, gum arabic, guar gum, xanthan gum, alginate, pectin, chitin, chitosan, carrageenan gum, inulin, and gellan gum.

18. The method of claim 17, wherein the gellan gum comprises low-acyl content gellan gum.

19. The method of any one of claims 16 to 18, wherein the w/v concentration of the rheology modifier in the silk formulation is between about 0.01% and about 5%, or between about 0.1% and about 1%.

20. The method of any one of claims 10 to 19, wherein the silk formulation further comprises a plasticizer.

21. The method of claim 20, wherein the plasticizer comprises one or more polyols, and/or one or more polyethers.

22. The method of claim 21, wherein the polyols are selected from one or more of glycol, glycerol, sorbitol, glucose, sucrose, and dextrose, and wherein the polyethers are one or more polyethyleneglycols (PEGs).

23. The method of any one of claims 20 to 22, wherein the w/v concentration of the plasticizer in the silk formulation is between about 0.01% and about 10%.

24. The method of any one of claims 10 to 23, wherein the silk formulation further comprises a defoaming agent at a concentration between about 0.001% and about 1%.

25. The method of claim 24, wherein the defoaming agent comprises a silicone.

26. The method of any one of claims 10 to 25, wherein the silk formulation is a liquid, a gel, a paste, a wax, or a cream.

27. The method of any one of claims 10 to 26, wherein the concentration of silk fibroin proteins or fragments thereof in the silk formulation is between about 0.1% w/v and about 15% w/v, or between about 0.5% w/v and about 12% w/v, or between about 5 mg/mL and about 125 mg/mL.

28. The method of any one of claims 10 to 27, wherein the silk formulation further comprises a pH adjusting agent.

29. The method of any one of claims 10 to 28, wherein treating the leather substrate with the silk formulation improves one or more of gloss and/or color saturation.

30. The method of any one of claims 10 to 29, the method further comprising one or more additional steps selected from dyeing the leather, drying the leather, water annealing, mechanically stretching the leather, trimming the leather, performing one or more polishing steps of the leather, applying a pigment to the leather, applying a colorant to the leather, applying an acrylic formulation to the leather, chemically

fixing the leather, stamping the leather, applying a silicone finish to the leather, providing a Uniflex treatment to the leather, and/or providing a Finiflex treatment to the leather, wherein the step of applying the silk formulation on a surface of the leather is performed before, during, or after the one or more additional steps.