textile can be laminated or otherwise combined with one or more additional layers, such as one or more layers of other textile materials (e.g., cotton or polyester). A resulting cloth can be used in a variety of articles of clothing, such as apparel and footwear, as well as other products.

Examples

[0060] The following examples describe specific aspects of some embodiments of this disclosure to illustrate and provide a description for those of ordinary skill in the art. The examples should not be construed as limiting this disclosure, as the examples merely provide specific methodology useful in understanding and practicing some embodiments of this disclosure.

Example 1

Formation of Nanoporous Polyethylene Fibers

[0061] Figure 6 is a process flow for forming nanoporous polyethylene (PE) fibers. PE is dissolved in paraffin oil under heating and agitation and then cooled to form a (solid) mixture of PE and paraffin oil. Referring to Figure 6, a weight-to-volume ratio of PE and paraffin oil is about 1 g to 3.5 mL, although other ratios can be used, such as from about 1 g to 0.5 mL to about 1 g to 10 mL or from about 1 g to 2 mL to about 1 g to 4.5 mL. The mixture of PE and paraffin oil is then extruded under heating to form PE fibers including paraffin oil dispersed in the fibers, and paraffin oil is extracted from the PE fibers by immersion in methylene chloride, leaving nanopores in the PE fibers and forming nanoporous PE fibers.

[0062] Figure 7 is a schematic diagram of an extrusion device for forming nanoporous PE fibers. A mixture of PE and paraffin oil is loaded inside a syringe, and the mixture is subjected to heating under control by a temperature controller through a heating tape and a thermocouple. A syringe pump compresses the mixture inside the syringe such that a PE fiber including paraffin oil is extruded from a tip of the syringe. The PE fiber is collected by a roller under control by a controller.

[0063] Figure 8 are scanning electron microscope (SEM) images of nanoporous PE fibers, at various levels of magnification. As shown in Figure 8, the fibers have interconnected nanopores. The nanopores can provide improved air and water vapor permeability, in addition to opacity towards visible light.

Claims

1. A fiber comprising:

an elongated member; and

refractive index contrast domains dispersed within the elongated member,

wherein the elongated member includes at least one polymer having a transmittance of infrared radiation at a wavelength of 9.5 μm of at least 40%, and

wherein the refractive index contrast domains comprise particulate fillers, wherein a volume percentage of the fillers within the elongated member is at least 10%.

2. The fiber of claim 1, wherein the elongated member includes at least one polyolefin.

3. The fiber of claim 1, wherein the elongated member includes at least one of polyethylene or polypropylene.

4. The fiber of claim 1, wherein:

the elongated member includes a blend of polyethylene and polypropylene, and a weight percentage of polypropylene relative to a combined weight of polyethylene and polypropylene is in a range of 1% to 50%; or

the elongated member includes a blend of polyethylene and polypropylene, and a weight percentage of polyethylene relative to a combined weight of polyethylene and polypropylene is in a range of 1% to 50%.

5. The fiber of claim 1, wherein the refractive index contrast domains further comprise pores.

6. The fiber of claim 5, wherein the pores have an average pore size in a range of 50 nm to 1000 nm.

7. The fiber of claim 5, wherein a volume percentage of the pores within the elongated member is at least 10%.

8. The fiber of claim 1, wherein the fillers have an average particle size in a range of 50 nm to 1000 nm.

9. The fiber of claim 1, wherein the fillers include an inorganic material.

10. The fiber of claim 1, wherein a difference in refractive index between the refractive index contrast domains and the elongated member is at least ±1% with respect to a refractive index of the elongated member.

11. The fiber of claim 1, wherein the elongated member is a first elongated member, and further comprising a second elongated member combined with the first elongated member to form a body of the fiber.

12. The fiber of claim 11, wherein a cross-sectional dimension of at least one of the first elongated member or the second elongated member is up to about 5 μm.

13. A woven textile including the fiber of any one of the preceding claims.

14. The woven textile of claim 15, having a transmittance of infrared radiation at a wavelength of 9.5 μm of at least 40%.

15. The woven textile of claim 15, having an opacity to visible light over a wavelength range of 400-700 nm of at least 40%.

16. A cloth comprising:

at least one layer including a woven textile including the fiber of any one of claims 1-12.

17. A method of regulating a temperature of a human body, comprising:

placing a woven textile adjacent to the human body, wherein the woven textile includes the fiber of any one of claims 1-12, wherein the method comprises a non-therapeutic method.