Summary

There is provided a method of producing a fluoropolymer article comprising

(i) subjecting a composition comprising fluoropolymer particles either dispersed in a dispersing medium or dissolved in a solvent to additive processing in an additive processing device containing at least one energy source wherein the composition comprises at least one polymerizable binder material capable of binding the fluoropolymer particles to form a layer in a part of the composition that has been exposed to the energy source of the additive processing device;

(ii) subjecting at least a part of the composition to exposure of the energy source to form a layer by polymerizing the binder material;

(iii) repeat step (ii) to form a plurality of layers to create an article;

(iv); at least partially removing the solvent or the dispersing medium from the article by treatment with a supercritical fluid.

There is also provided a method of producing a fluoropolymer article comprising

(i) providing a fluoropolymer article comprising fluoropolymer and one or more binder materials, wherein the article comprises less than 20% by weight based on the total weight of the article of solvent and/or water;

(ii) subjecting the article to a heat treatment to remove or decompose the binder material.

There is also provided a method of producing a fluoropolymer article comprising

(i) providing a fluoropolymer article containing fluoropolymer, binder material, solvent and/or water;

(ii) at least partially removing the solvent or the dispersing medium from the article by treatment with a supercritical fluid.

In one aspect there is provided a method of producing a fluoropolymer article comprising (i) providing a fluoropolymer article containing fluoropolymer particles, a polymerized binder material binding the fluoropolymer particles, and an organic solvent; and (ii) at least partially removing the organic solvent from the article by treatment with a supercritical fluid, wherein the organic solvent is miscible with the supercritical fluid; wherein the fluoropolymer is selected from the group consisting of tetrafluoroethene homopolymers, tetrafluoroethene copolymers containing up to 1% by weight of perfluorinated alpha-olefin comonomers, and tetrafluoroethene copolymers containing more than 1% by weight and up to 30% by weight based on the weight of the polymer of perfluorinated comonomers, partially fluorinated comonomers and non-fluorinated comonomers.

There is also provided an article comprising a curved surface wherein the curved surface comprises a fluoropolymer and has a surface roughness (Ra) of less than 8 μm, preferably less than 6 μm and more preferably less than 5.5 μm and wherein the fluoropolymer is selected from the group consisting of tetrafluoroethylene homopolymers, tetrafluoroethylene copolymers containing up to 1% by weight of perfluorinated alpha-olefin comonomers, and tetrafluoroethylene copolymers containing more than 1% by weight and up to 30% by weight based on the weight of the polymer of perfluorinated comonomers, partially fluorinated comonomers and non-fluorinated comonomers.

CLAIMS

1. A method of producing a fluoropolymer article comprising

(i) providing a fluoropolymer article containing fluoropolymer particles, a polymerized binder material binding the fluoropolymer particles, and an organic solvent; and

(ii) at least partially removing the organic solvent from the article by treatment with a supercritical fluid, wherein the organic solvent is miscible with the supercritical fluid;

wherein the fluoropolymer is selected from the group consisting of tetrafluoroethene homopolymers, tetrafluoroethene copolymers containing up to 1% by weight of perfluorinated alpha-olefin comonomers, and tetrafluoroethene copolymers containing more than 1% by weight and up to 30% by weight based on the weight of the polymer of perfluorinated comonomers, partially fluorinated comonomers and non-fluorinated comonomers.

2. The method of claim 1, wherein the article is obtainable by

(i) subjecting a composition comprising fluoropolymer particles either dispersed in a dispersing medium comprising the organic solvent or dissolved in the organic solvent to additive processing in an additive processing device containing at least one energy source wherein the composition comprises at least one polymerizable binder material capable of binding the fluoropolymer particles to form a layer in a part of the composition that has been exposed to the energy source of the additive processing device;

(ii) subjecting at least a part of the composition to exposure of the energy source to form a layer by polymerizing the polymerizable binder material to form the polymerized binder material and bind the fluoropolymer particles; and

(iii) repeating step (ii) to form a plurality of layers to create the article.

3. The method of claim 1, wherein the article is obtainable by

(i) subjecting a composition comprising fluoropolymer particles dispersed in a dispersing medium comprising water or a solvent immiscible with the supercritical fluid to additive processing in an additive processing device containing at least one energy source wherein the composition comprises at least one polymerizable binder material capable of binding the fluoropolymer particles to form a layer in a part of the composition that has been exposed to the energy source of the additive processing device;

(ii) subjecting at least a part of the composition to exposure of the energy source to form a layer by polymerizing the polymerizable binder material to form the polymerized binder material and bind the fluoropolymer particles;

(iii) repeating step (ii) to form a plurality of layers to create the article; and

(iv) exchanging the water or the solvent immiscible with the supercritical fluid with the organic solvent that is miscible with the supercritical fluid.

4. The method of any one of claims 1 to 3, wherein the organic solvent is an alcohol.

5. The method of claim 1, wherein the fluoropolymer is selected from the group consisting of tetrafluoroethene homopolymers, and tetrafluoroethene copolymers containing up to 1% by weight of perfluorinated alpha-olefin comonomers.

6. The method of claim 1, wherein the fluoropolymer is selected from the group of fluoropolymers having a melt flow index at 372°C and 5 kg load (MFI 372/5) of less than 1 g/10 min, a melt flow index at 372°C and 5 kg load (MFI 372/5) of less than 0.1 g / 10 min, or a melt flow index at 372°C and 5 kg load (MFI 372/5) of from 1 to 50 g / 10 min; wherein the melt flow index is measured according to DIN EN ISO 1131.

7. The method of claim 1, wherein the binder material comprises a material comprising polymerized or polymerizable acrylate groups.

8. The method of claim 1, wherein the article contains less than 10 % by weight based on the weight of the article of water.

9. An article being obtainable by the method of any one of claims 1 to 3, the article comprising a curved surface wherein the curved surface comprises a fluoropolymer and has a surface roughness (Ra) of less than 8 µm as measured according to the Surface Roughness Procedure and wherein the fluoropolymer is selected from the group consisting of tetrafluoroethene homopolymers, tetrafluoroethene copolymers containing up to 1% by weight of perfluorinated alpha-olefin comonomers, and tetrafluoroethene copolymers containing more than 1% by weight and up to 30% by weight based on the weight of the polymer of perfluorinated comonomers, partially fluorinated comonomers and non-fluorinated comonomers.

10. The article of claim 9 wherein the fluoropolymer is selected from the group of fluoropolymers having a melt flow index at 372°C and 5 kg load (MFI 372/5) of less than 0.1 g / 10 min, and from 1 to 50 g / 10 min; wherein the melt flow index is measured according to DIN EN ISO 1131.

11. The article of claim 9 wherein the fluoropolymer is a tetrafluoroethene copolymer containing more than 1% by weight and up to 30% by weight based on the weight of the polymer of perfluorinated comonomers, partially fluorinated comonomers and non-fluorinated comonomers and wherein the fluoropolymer has a melting point between 260°C and 315°C.

12. The article of claim 9 wherein the curved surface is the surface of a shape selected from cylinders, half-cylinders, spheres, half-spheres and combinations thereof.

13. The article of claim 9 wherein the curved surface is the interior surface of a channel for transporting fluids or gases that is or will be exposed to the transporting fluids or gases.

14. The article of claim 9 wherein the article is selected from molds, housings or seats of a valve, seals, pistons, joints, closure systems or a component thereof.

15. The article of claim 9 being a device for processing or storing biological material including food, blood, tissues and pharmaceuticals.