Claims

What is claimed is:

1. A composite powder material, preferably with optimized flow properties for powder processing technologies, comprising a polymer powder and a water-soluble salt; wherein the water-soluble salt is a flow aid,
and wherein the water-soluble salt is embedded into the particle surface of polymeric powder.
2. The material of claim 1, wherein the water-soluble salt is embedded into the particle surface of the polymeric powder by mixing or milling.
3. The material according to any of claims 1 to 2, wherein the polymer powder comprises a processed polymer powder or a non-processed polymer powder.
4. The material according to any of claims 1 to 3, wherein the polymer powder is a blended mixture of virgin polymer powder and processed polymer powder; and wherein the processed polymer powder was annealed during laser sintering processing.
5. The material according to any of claims 1 to 4, wherein the polymer, which forms the polymer powder, is produced from p-dioxanone monomer, l-lactide monomer, d-lactide monomer, glycolide monomer, caprolactone monomer, or a combination thereof.
6. The material according to any of claims 1 to 5, wherein the water-soluble salt is magnesium sulfate, sodium sulfate, potassium chloride, sodium chloride, sodium sulfate, aluminum potassium sulfate, magnesium chloride, or magnesium chloride hexahydrate or a mixture thereof.
7. The material according to any of claims 1 to 6, wherein the water-soluble salt comprises not more than about 50wt%, preferably between 0.01wt% to 30 wt%, more preferably between 0.01wt% to 20wt% of the composite powder material.
8. The material according to any of claims 1 to 7, wherein the polymer powder comprises not more than about 99wt%, preferably between 70wt% to 95wt% or 80wt% to 99wt% of the composite powder material.
9. A method of producing a 3D article comprising the composite powder material of any of claims 1 to 8, wherein the method comprises:
    (a) applying and irradiating a base anchoring layer of polymer of similar base geometry to the 3D article being produced;
    (b) applying a layer of the composite powder material to a printing area;
    (c) sintering the cross-sectional area of the 3D article being produced;
    (d) applying multiple layers of the composite powder material to the printing area on top of the base anchoring layer until a full 3D article has been printed;

(e) annealing the composite powder material one second to 8 hours at a temperature of from preferably 8°C to 60°C, more preferably 9°C to 50°C, and most preferably 10°C to 35°C below initial polymer melting temperature; and

(f) cooling the composite powder material at a controlled cooling rate of preferably 0.1°C/min to 35°C/min, more preferably 1°C/min to 20°C/min, and most preferably 2°C/min to 5°C/min.

10. The method of claim 9, wherein the irradiated base anchoring layer is further supported by a base support below; or, wherein a base support is added to any structure other than the base geometry.

11. The method of claim 10, wherein the base support is irradiated with a different energy density from the 3D article being produced by laser sintering.

12. The method of claim 10 or claim 11, wherein the base support can be removed from the 3D article being produced; and wherein the base geometry can be separated into its initial powder form through sieving.

13. The method according to any of claims 9 to 12, wherein engineering stresses can be embedded into the 3D article being produced by altering an energy density of the laser sintering process between 0.01 J/mm^3 to 5.0 J/mm^3.