CLAIMS

What is claimed is:

1. A system for solid freeform fabrication of a three-dimensional object, comprising: a solid freeform fabrication apparatus that deposits small beads of building materials in a controlled manner;

wherein said building materials comprises a thermoplastic polyurethane derived from (a) a polyisocyanate component, (b) a polyol component, and (c) an optional chain extender component;

wherein the resulting thermoplastic polyurethane has a crystallization temperature above 80°C; and

wherein the resulting thermoplastic polyurethane retains more than 20% of its shear storage modulus at 100°C relative to its shear storage modulus at 20°C, where modulus is measured according to ASTM D5279.

2. A method of fabricating a three-dimensional object, comprising the step of: (I) operating a system for solid freeform fabrication of an object;

wherein said system comprises a solid freeform fabrication apparatus that deposits small beads of building materials in a controlled manner;

so as to form the three-dimensional object;

wherein said building materials comprises a thermoplastic polyurethane derived from (a) a polyisocyanate component, (b) a polyol component, and (c) an optional chain extender component;

wherein the resulting thermoplastic polyurethane has a crystallization temperature above 80°C; and

wherein the resulting thermoplastic polyurethane retains more than 20% of its shear storage modulus at 100°C relative to its shear storage modulus at 20°C, where modulus is measured according to ASTM D5279.

3. An article of manufacturing, fabricated by a system for solid freeform fabrication of an object, comprising: a solid freeform fabrication apparatus that deposits small beads of building materials in a controlled manner;

wherein said building materials comprises a thermoplastic polyurethane derived from (a) a polyisocyanate component, (b) a polyol component, and (c) an optional chain extender component;

wherein the resulting thermoplastic polyurethane has a crystallization temperature above 80°C; and

wherein the resulting thermoplastic polyurethane retains more than 20% of its shear storage modulus at 100°C relative to its shear storage modulus at 20°C, where modulus is measured according to ASTM D5279.

4. The system or method or article of any of claims 1 to 3, wherein said solid freeform fabrication apparatus comprises (a) a plurality of dispensing heads; (b) a building material supply apparatus configured to supply a plurality of building materials to said fabrication apparatus; and (c) a control unit configured for controlling said fabrication apparatus and said building material supply apparatus, based on an operation mode selected from a plurality of predetermined operation modes.

5. The system or method or article of any of claims 1 to 4, wherein said solid freeform fabrication apparatus comprises a fused deposition modeling apparatus.

6. The system or method or article of any of claims 1 to 5, wherein the mole ratio of the chain extender to the polyol is greater than 1.5.

7. The system or method or article of any of claims 1 to 6, wherein the polyol has a number average molecular weight of at least 900.

8. The system or method or article of any of claims 1 to 7, wherein the polyisocyanate component comprises an aromatic diisocyanate.

9. The system or method or article of any of claims 1 to 7, wherein the polyisocyanate component comprises 4,4′-methylenebis(phenyl isocyanate).

10. The system or method or article of any of claims 1 to 9, wherein the polyol component comprises poly(tetramethylene ether glycol), polybutylene adipate, or a combination thereof.

11. The system or method or article of any of claims 1 to 10, wherein the chain extender component comprises a linear alkylene diol.

12. The system or method or article of any of claims 1 to 11, wherein the chain extender component comprises 1,4-butanediol.

13. The system or method or article of any of claims 1 to 12, wherein the thermoplastic polyurethane further comprises one or more colorants, antioxidants (including phenolics, phosphites, thioesters, and/or amines), antiozonants, stabilizers, inert fillers, lubricants, inhibitors, hydrolysis stabilizers, light stabilizers, hindered amines light stabilizers, benzotriazole UV absorber, heat stabilizers, stabilizers to prevent discoloration, dyes, pigments, inorganic and organic fillers, reinforcing agents, or any combinations thereof.

14. The article of any of the claims 4 to 13, wherein said article comprises cook and storage ware, furniture, automotive components, toys, sportswear, medical devices, personalized medical articles, replicated medical implants, dental articles, sterilization containers, drapes, gowns, filters, hygiene products, diapers, films, sheets, tubes, pipes, wire jacketing, cable jacketing, agricultural films, geomembranes, sporting equipment, cast film, blown film, profiles, boat and water craft components, crates, containers, packaging, labware, office floor mats, instrumentation sample holders, liquid storage containers, packaging material, medical tubing and valves, a footwear component, a sheet, a tape, a carpet, an adhesive, a wire sheath, a cable, a protective apparel, an automotive part, a coating, a foam laminate, an overmolded article, an automotive skin, an awning, a tarp, a leather article, a roofing construction article, a steering wheel, a powder coating, a powder slush molding, a consumer durable, a grip, a handle, a hose, a hose liner, a pipe, a pipe liner, a caster wheel, a skate wheel, a computer component, a belt, an applique, a footwear component, a conveyor or timing belt, a glove, a fiber, a fabric, or a garment.

15. A medical device fabricated from a system for solid freeform fabrication, wherein the medical device is manufactured by a solid freeform fabrication apparatus that deposits small beads of building materials in a controlled manner; wherein the building materials comprise a thermoplastic polyurethane derived from (a) a polyisocyanate component, (b) a polyol component, and (c) an optional chain extender component; wherein the resulting thermoplastic polyurethane has a crystallization temperature above 80° C; and wherein the resulting thermoplastic polyurethane retains more than 20% of its shear storage modulus at 100° C relative to its shear storage modulus at 20° C, where modulus is measured according to ASTM D5279.