What is claimed is:

1. A composite multi-layer pipe, comprising an inner-layer pipe, an outer-layer pipe, and a middle-layer pipe positioned between the inner-layer pipe and the outer-layer pipe;

the inner-layer pipe having a material comprising a SiC particle reinforced aluminum-based composite material;

the middle-layer pipe having a material comprising a foamed aluminum-based material;

the outer-layer pipe having a material comprising an aluminum-lithium alloy;

wherein the SiC particle reinforced aluminum-based composite material is prepared by a method comprising the following steps:

(b1) mixing silicon powder, carbon powder and aluminum-based powder according to a mass ratio of Si: C: Al=37-47: 22-32: 1-5 to obtain a mixed powder;

(b2) placing the mixed powder in a mold and performing hot pressing and sintering to obtain preforms, wherein the preforms having dimensions ranging from 10 mm to 50 mm in at least one direction;

(b3) providing a molten aluminum alloy;

(b4) putting 5-15 weight parts of the preforms into 85-95 weight parts of the molten aluminum alloy so that the preforms decompose and react in the molten aluminum alloy; and

(b5) manufacturing the product of the previous step into a green body by a spray forming technique.

2. The composite multi-layer pipe according to claim 1, characterized in one or more of the following:

(1) the SiC particle reinforced aluminum-based composite material has an aluminum-silicon alloy matrix with SiC particles dispersed therein;

(2) the SiC particle reinforced aluminum-based composite material has a SiC particle content of 5-10 wt%;

(3) the foamed aluminum-based material has a porosity of 50-65%;

(4) the aluminum-lithium alloy is 2195 aluminum-lithium alloy; and

(5) the inner-layer pipe, middle-layer pipe and outer-layer pipe have thicknesses of 4-7mm, 2-4mm and 2-4mm, respectively.

3. The composite multi-layer pipe according to claim 1, wherein the composite multi-layer pipe is a concrete conveying pipe for concrete pumping equipment.

4. The composite multi-layer pipe according to claim 1, wherein the composite multi-layer pipe is a concrete conveying pipe for a boom-type concrete pumping truck.

5. The composite multi-layer pipe according to claim 1, wherein the composite multi-layer pipe has one or more of the following performances:

(1) the inner-layer pipe has a wear rate of 0.050% to 0.150%;

(2) the multi-layer pipe has a density of 1.8-2.2 g/cm^3; and

(3) the multi-layer pipe has a rigidity of 80% or more of that of a steel structure having the same specification.

6. A method for preparing the composite multi-layer pipe according to claim 1, comprising the following steps:

(a1) providing a green body, wherein said green body having a material comprising a SiC particle reinforced aluminum-based composite material;

(a2) extruding the green body into a pipe by using an extrusion forming device to form an inner-layer pipe;

(a3) placing a middle-layer pipe at an extrusion outlet of the extrusion forming device so that the extruded inner-layer pipe is nested in the middle-layer pipe; and

(a4) nesting the middle-layer pipe in an outer-layer pipe;

wherein the green body is prepared by a method comprising:

(b1) mixing silicon powder, carbon powder and aluminum-based powder according to a mass ratio of Si: C: Al=37-47: 22-32: 1-5 to obtain a mixed powder;

(b2) placing the mixed powder in a mold and performing hot-pressing and sintering to obtain preforms, wherein the preforms having dimensions ranging from 10 mm to 50 mm in at least one direction;

(b3) providing a molten aluminum alloy;

(b4) putting 5-15 weight parts of the preform into 85-95 weight parts of the molten aluminum alloy so that the preforms decompose and react in the molten aluminum alloy; and

(b5) manufacturing the product of the previous step into a green body by a spray forming technique.

7. The method according to claim 6, characterized in one or more of the following:

in (a3), the inner-layer pipe and the middle-layer pipe are in an interference fit with an interference amount of 0.5-1.5 mm;

in (a4), the middle-layer pipe and the outer-layer pipe are in an interference fit with an interference amount of 0.5-1.5mm.

8. The method according to claim 6, wherein the middle-layer pipe has a first end and a second end;

in step (a3), along a direction from the first end to the second end, the inner-layer pipe is gradually nested in the middle-layer pipe;

in step (a4), along a direction from the second end to the first end, the middle-layer pipe is gradually nested in the outer-layer pipe.

9. The method according to claim 6, wherein in step (a2), the step of extruding forming is characterized in one or more of the following:

(1) an extrusion ratio of 3-4: 1 is applied;

(2) an extrusion temperature of from 380℃ to 420℃ is applied;

(3) an extrusion speed of 5-15 mm/s is applied;

(4) an oil-based molybdenum disulfide is used as a lubricant between the pipe and the device during an extrusion process; and

(5) a friction coefficient at 0.1 to 0.3 is applied between the pipe and the device during an extrusion process.

10. The method according to claim 6, wherein step (b1) is characterized in one or more of the following:

(1) the silicon powder has a particle size of 30-40 μm;

(2) the carbon powder has a particle size of 5-15 μm; and

(3) the aluminum-based powder has a particle size of 40-70 μm.

11. The method according to claim 6, wherein in step (b5), the spray forming technique has parameters characterized in one or more of the following:

(1) a superheat degree of a molten body is kept at from 200℃ to 210℃;

(2) nitrogen gas is used as an atomizing gas; and

(3) an atomizing gas pressure of 0.8-0.9 MPa is applied.

12. The method according to claim 6, wherein between steps (b4) and (b5) further comprising:

adding 0.4 wt% of hexachloroethane into the molten aluminum alloy to perform a refining.

13. The method according to claim 6, wherein the middle-layer pipe is prepared by a method comprising:

(c1) nesting a plurality of aluminum-based pipes with each other, and disposing a foaming agent between adjacent aluminum-based pipes;

(c2) pressing the plurality of aluminum-based pipes along a thickness direction thereof with a press ratio of 1.2 to 2; and

(c3) heating the pressed pipes to 600-700°C to make the foaming agent foam and form a foam structure.

14. The method according to claim 13, wherein step (c3) comprises:

providing a heating device, in which the heating device comprises a heating chamber, and said heating chamber comprising a first temperature zone, a second temperature zone, a third temperature zone, a fourth temperature zone and a fifth temperature zone along a direction from an inlet to an outlet of the heating chamber, the temperature zones respectively have temperatures of 250-350°C, 400-500°C, 600-700°C, 400-500°C, 250-350°C in sequence; and

moving the pipes at a preset speed along a direction parallel to a length of the pipes so that a product of the previous step enters from an inlet of the heating chamber, is heated in the heating chamber, and finally leaves an outlet of the heating chamber.

15. The method according to claim 14, wherein the first temperature zone, the second temperature zone, the third temperature zone, the fourth temperature zone and the fifth temperature zone respectively have lengths of: 15-25 mm, 25-35 mm, 35-45 mm, 25-35mm, 15-25 mm in sequence, and the pipes move at a speed of 3-5 mm/min.

16. The method according to claim 13, characterized in one or more of the following:

(1) in step (c1), said plurality of aluminum-based pipes are 3 to 5 aluminum-based pipes;

(2) in step (c1), said foaming agent is TiH_2 powder.