CLAIMS

1. A hollow roto-moulded article, having an inner wall defining an interior of the article and integrally formed structure with the inner wall, wherein the integrally formed structure protrudes into the interior of the article, the article formed of a first layer including one or more thermoplastic polymers, and a second layer including one or more fibrous materials.

2. The hollow roto-moulded article of claim 1, wherein the one or more fibrous materials is at least partly infiltrated with the one or more thermoplastic polymers; and/or

   wherein the article includes at least one cavity extending towards the interior of the article, wherein the cavity includes an internal surface profile that substantially corresponds to an external surface profile of the integrally formed structure.

3. The hollow roto-moulded article of claim 2, wherein the article includes a recess disposed about a periphery of the at least one cavity, wherein the recess is configured to facilitate engagement of one or more subsequent layers to the first and second layers.

4. The hollow roto-moulded article of claim 3, further including reinforcement disposed in the at least one cavity, wherein the reinforcement is configured to stiffen and/or strengthen at least a portion of the integrally formed structure.

5. The hollow roto-moulded article of claim 4, wherein the reinforcement includes a structural skin fixed in the at least one cavity; and/or

   wherein the reinforcement includes bracing structure adapted to be connected in the at least one cavity, the bracing structure including a plurality of bracing elements fixed in the cavity and arranged to stiffen and/or strengthen the integrally formed structure.

6. The hollow roto-moulded article of claim 5, wherein the bracing elements are of substantially beam-like form and are arranged in a substantially lattice framework.

7. The hollow roto-moulded article of claim 5 or 6, wherein the bracing structure is fixed to the structural skin.

8. The hollow roto-moulded article of any one of the preceding claims, wherein the integrally formed structure protruding into the interior of the article is one or more baffles.

9. The hollow roto-moulded article of claim 8, wherein the one or more baffles are arranged to extend in a direction substantially parallel to a longitudinal axis of the article.

10. The hollow roto-moulded article of claim 8, wherein the one or more baffles are arranged to extend in a direction substantially perpendicular to a longitudinal axis of the article.

11. The hollow roto-moulded article of claim 10, wherein a pair of baffles extend into the interior of the article from substantially opposed locations of the inner wall and form a gap therebetween.

12. The hollow roto-moulded article of claim 11, wherein the gap is substantially V-shaped when the article is viewed in transverse cross-section, wherein a narrower end of the V-shaped gap is disposed at a lower end of the article, and a wider end of the V-shaped gap is disposed at an upper end of the article.

13. The hollow roto-moulded article of any one of claims 8 to 12, wherein the or each baffle includes a first baffle wall and a second baffle wall each extending from the inner wall of the article into the interior of the article and merging into a baffle tip.

14. The hollow roto-moulded article of claim 13, wherein the first and second baffle walls are angled towards one another, thereby defining a substantially U-shaped baffle when the baffle is viewed in transverse cross section.

15. The hollow roto-moulded article of claim 13 or 14, wherein the or each baffle includes a tip transition portion between the first baffle wall and the baffle tip and between the second baffle wall and the baffle tip, wherein the tip transition portions are substantially curved, thereby defining a smooth transition profile between the first baffle wall and the baffle tip and between the second baffle wall and the baffle tip.

16. The hollow roto-moulded article of claim 15, wherein a radius of curvature of the tip transition portions is in the range of about 2 mm to about 500 mm.

17. The hollow roto-moulded article of any one of claims 13 to 16, wherein the article includes substantially curved base transition portions between the inner wall and the first baffle wall and between the inner wall and the second baffle wall.

18. The hollow roto-moulded article of any one of claims 13 to 17, wherein an external surface profile of the or each baffle is substantially continuous with the inner wall, thereby providing seamless transition between the inner wall of the article, the first wall, the second wall and the baffle tip.

19. The hollow roto-moulded article of any one of the preceding claims, wherein the one or more thermoplastic polymers in the first layer include one or more of ethylene homopolymers, ethylene co-polymers, propylene homopolymers, propylene co-polymers, fluoropolymers, polyvinylchloride, polyvinylidene chloride, polyaryl ether ketone and polyamide.

20. The hollow roto-moulded article of any one of the preceding claims, wherein the one or more fibrous materials in the second layer include one or more of glass fibre, carbon fibre and basalt fibres, or precursors thereof.

21. The hollow roto-moulded article of any one of the preceding claims, wherein the article includes a third layer including a plurality of filaments selected from one or more of carbon, glass, aramid and basalt filaments, and one or more thermosetting polymers, wherein the second layer is disposed between the first layer and the third layer, and wherein the one or more fibrous materials is at least partly infiltrated with both the one or more thermoplastic polymers and the one or more thermosetting polymers.

22. The hollow roto-moulded article of claim 21, wherein the one or more thermosetting polymers of the third layer comprise one or more of vinyl ester, bismaleimide, polyester, polyacrylate, epoxy, and polyurethane.

23. The hollow roto-moulded article of any of the preceding claims, wherein the article is a hollow composite vessel, and the integral structure is configured to reduce surge forces experienced by the hollow composite vessel in use.

24. A method of producing a hollow composite vessel of claim 23, the method including:

applying one or more fibrous materials to an internal surface of a hollow mould, the hollow mould including structure protruding into an interior of the mould;

heating and rotating the hollow mould in the presence of one or more thermoplastic polymers within the hollow mould so that the polymer melts and at least partially infiltrates the fibrous material;

cooling the mould so that the thermoplastic polymer solidifies; and

releasing a hollow thermoplastic polymer/fibrous material composite vessel having integrally formed structure protruding into an interior of the vessel from the mould.

25. The method of claim 24, further including reinforcing the integrally formed structure before applying additional layer(s) to the hollow thermoplastic polymer/fibrous material composite vessel.

26. The method of claim 24, further including one or more of the following:

applying a plurality of filaments selected from one or more of carbon, glass, aramid and basalt filaments to the outside of the hollow thermoplastic polymer/fibrous material composite vessel wherein prior to application the plurality of filaments are at least partly wetted with one or more thermosetting polymers;

applying a plurality of filaments selected from one or more of carbon, glass, aramid and basalt filaments to the outside of the hollow thermoplastic polymer/fibrous material composite vessel followed by application of one or more thermosetting polymers;

applying one or more thermosetting polymers to the outside of the hollow thermoplastic polymer/fibrous material composite vessel followed by application of a plurality of filaments selected from one or more of carbon, glass, aramid and basalt filaments.

27. The method of any one claims 24 to 26, wherein the structure of the hollow mould protruding into the interior of the mould is one or more baffle mould portions each adapted to produce a cavity of substantially the same form in the hollow thermoplastic polymer/fibrous material composite vessel.

28. The method of any one of claims 24 or 27, wherein the hollow mould further includes a protrusion disposed about a periphery of the structure protruding into an interior of the mould, wherein the hollow thermoplastic polymer/fibrous material composite vessel thereby includes a recess extending through the outer wall of the thermoplastic polymer/fibrous material composite, the recess disposed about a periphery of the cavity.