CLAIMS

1. Heat exchanger material for use in heat exchangers of cryogenic cooling systems, the heat exchanger material consisting of solid material rendered into its final form by an additive manufacturing process and having a surface-to-volume ratio of at least 10^5 1/m.

2. A heat exchanger material according to claim 1, comprising a plurality of extended thermal conduction paths in the form of regularly shaped portions of said solid material that extend through a majority of a thickness of the material and occur in a repetitive pattern throughout a layer of said material.

3. A heat exchanger material according to claim 1 or 2, having a recursive surface structure in which surface features of first characteristic dimension are covered with similar surface features of second characteristic dimension smaller than said first characteristic dimension.

4. A heat exchanger material according to any of claims 1 to 3, said material defining a recursive spatial form in which first spatial features of a piece of said material have a first characteristic dimension and consist of second, similar spatial features of a second characteristic dimension smaller than said first characteristic dimension.

5. A heat exchanger material according to any of claims 1 to 4, wherein at least one surface of the material comprises a maze defined by a plurality of mesh-formed or matrix-formed layers stacked on top of a solid surface of said material, at least some of said mesh-formed or matrix-formed layers having solid stretches that bridge openings in a respective adjacent mesh-formed or matrix-formed layer.

6. A heat exchanger material according to any of claims 1 to 5, wherein said solid material comprises at least one of: copper, silver, plastic.

7. Heat exchanger for transferring thermal energy to or from a liquid cryogen, the heat exchanger comprising a surface of a liquid cryogen space and, as a part of said surface, heat exchanger material according to any of claims 1 to 6.

8. A heat exchanger according to claim 7, comprising a base structure that limits said liquid cryogen space and a multitude of protrusions extending from said base structure into said liquid cryogen space, so that said surface of said liquid cryogen space comprises surfaces of said protrusions.

9. Heat exchanger according to claim 8, wherein said multitude of protrusions constitute a recursively repeating branching structure based on each individual protrusion of at least said majority of protrusions.

10. Heat exchanger according to any of claims 7 to 10, wherein said solid material comprises a maze defined by layered meshes or particle matrices on said surface of the base structure.

11. Heat exchanger according to claim 10, wherein said maze is defined by layers of mesh or particle matrix on top of each other with a lateral shift between consecutive ones of said layers of mesh or particle matrix.

12. Heat exchanger according to claim 7, comprising a liquid cryogen vessel divided into at least two separate liquid cryogen spaces by a partition wall, so that said surface of said liquid cryogen space comprises at least one surface of said partition wall.

13. A cryogenic cooling system comprising:
- a flow path for a liquid cryogen and
- along said flow path at least one heat exchanger for transferring thermal energy to or from a liquid cryogen flowing through said flow path;
wherein said at least one heat exchanger is a heat exchanger according to any of claims 7 to 12,
and wherein said heat exchanger material in said at least one heat exchanger is exposed to liquid cryogen on said flow path.