CLAIMS

1. A molten salt nuclear reactor comprising:

a molten fuel-salt,

a neutron moderator material, and

cladding material surrounding the neutron moderator material and separating the neutron moderator material from the molten fuel-salt, the cladding material having gas permeability less than 10^-6 square meters per second.

2. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the cladding comprises a ceramic material.

3. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the cladding comprises a metal.

4. The molten salt nuclear reactor ~~apparatus~~ of claim 2 in which the cladding comprises silicon carbide.

5. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the cladding is capable of resisting a pressure differential.

6. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the molten fuel-salt, cladding, neutron moderator material and geometry of the molten-salt reactor may be selected and arranged so that an accident condition will accelerate the destruction or failure of the cladding and the impairment or decomposition of the neutron moderator material.

7. The molten salt nuclear reactor ~~apparatus~~ of claim 6 in which the cladding, the neutron moderator material, and/or the molten-salt reactor are designed so that a physical collapse of the molten-salt reactor would tend to break the cladding.

8. The molten salt nuclear reactor ~~apparatus~~ of claim 6 comprising a safety mechanism that causes destruction of the cladding by operator action.

9. The molten salt nuclear reactor ~~apparatus~~ of claim 6 in which the molten-salt reactor comprises ports through which a laser could strike the cladding and accelerate its failure.

10 The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the neutron moderator material is tuned to promote or discourage the release of gasses at high temperatures.

11. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the neutron moderator material varies within a core of the molten-salt reactor and/or within a given moderator pin.

12. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the neutron moderator material is movable throughout a core of the molten-salt reactor.

13. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the cladding and/or the neutron moderator material is replaceable.

14. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which sections of moderator encased in cladding are moveable within the molten-salt reactor.

15. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the used cladding and/or neutron moderator material are packaged so as to minimize thermal and/or mechanical stress on the components.

16. The molten salt nuclear reactor ~~apparatus~~ of claim 2 in which the ceramic consists of a ceramic other than silicon carbide, such as titanium carbide, zirconium carbide, ternary titanium silicon carbide, or graphite, applied either singly, as a mixture, or in layers.

17. An article of manufacture for a molten-salt reactor, the article comprising a moderating material and a cladding material wherein the cladding material extends the life of the moderating material after exposure of the article to molten fuel-salt by inhibiting contact between the moderating material and the molten fuel-salt during operation of the molten-salt reactor.

18. A method comprising:

providing solid moderator assemblies comprising a moderator and cladding prior to first commissioning of a molten fuel-salt reactor, the moderator and the cladding being configurable such that the cladding inhibits contact between the moderator and a molten fuel-salt during operation of the molten fuel-salt reactor; and

providing additional solid moderator assemblies for replacement.

19. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which a surface treatment was applied to the cladding to promote a particular flow regime in any fluid interacting with the cladding.

20. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which a surface treatment was applied to the neutron moderator material to remove potential undesirable surface effects.

21. The molten salt nuclear reactor ~~apparatus~~ of claim 1 in which the neutron moderator material, cladding, and/or molten fuel-salt form an involute shape.