Claims

1. A thermal insulation material (1), the thermal insulation material (1) having a composition comprising:
   1% to 20% of a clay mineral by total weight of the composition;
   20% to 50% of a base by total weight of the composition, wherein the base is selected from aluminium hydroxide, magnesium hydroxide, huntite, hydromagnesite, various hydrates, metal phosphates, hydrated calcium, boron compounds, and borates;
   15% to 40% of a non-halogenated flame retardant by total weight of the composition;
   1% to 15% of a non-alkaline borate by total weight of the composition; and
   20% to 40% of a starch by total weight of the composition, wherein the thermal insulation material (1) is malleable and is capable of self-hardening and forming an internal vapor barrier when exposed to fire or a temperature exceeding 100 °C, thereby preventing the transfer of fire or heat.

2. The thermal insulation material (1) according to claim 1, wherein the clay mineral is montmorillonite.

3. The thermal insulation material (1) according to claim 1 or 2, wherein the non-halogenated flame retardant is selected from red phosphorus, organic phosphates and phosphonates, melamine phosphate, melamine derivatives, melamine cyanurate, expandable graphite, talc, and ammonium polyphosphate.

4. The thermal insulation material (1) according to any one of claims 1 to 3, wherein the non-alkaline borate is selected from boric acid, zinc borate, borax and calcium borate.

5. The thermal insulation material (1) according to any one of claims 1 to 4, wherein the starch is selected from cornstarch, tapioca, arrowroot, wheat starch, rice starch, potato starch, sweet potato starch, sago, green bean starch, and artificial starch.

6. The thermal insulation material (1) according to any one of claims 1 to 5, further comprising a silica.

7. The thermal insulation material (1) according to claim 6, wherein the silica is selected from quartz, tridymite, cristobalite, coesite, stishovite, lechatelierite, and chalcedony.

8. The thermal insulation material (1) according to claim 6 or 7, wherein the silica is present at 1% to 15% by total weight of the composition.

9. The thermal insulation material (1) according to any one of claims 1 to 8, further comprising a polymer resin.

10. The thermal insulation material (1) according to claim 9, wherein the polymer resin is a thermoplastic resin selected from polyethylene, polyvinyl chloride, polystyrene, polypropylene, polycarbonate, polytetrafluoroethylene, polyether, ether ketone, polyoxymethylene, polyamide, acrylic, phenol formaldehyde resin, acrylonitrile-butadiene-styrene, acrylonitrile styrene acrylate, polyvinyl acetate, ethylene-vinyl acetate, vinyl acetate-vinyl chloride, polyvinyl alcohol, and polybutylene terephthalate.

11. The thermal insulation material (1) according to claim 9, wherein the polymer resin is a thermosetting resin selected from polyester, vinyl ester, vinyl acetate, epoxy, phenolic, polyurethane, and bismaleimide.

12. The thermal insulation material (1) according to any one of claim 9 to 11, wherein the polymer resin is present at 1% to 10% by total weight of the composition.

13. A fire and heat protection system (100) for a duct or a pipe (120) comprising a thermal insulation material (1) according to any one of claims 1 to 12, the system comprising:
a malleable wrapping material (110) comprising:
a core (10) comprising a core layer (11) made of the thermal insulation material (1) sandwiched between a first ceramic fiber layer (12) and a second ceramic fiber layer (13);
a fire retardant shrink wrap (20) enwrapping the core (10); and

an aluminium foil (30) enwrapping the core (10) enwrapped in the shrink wrap (20),

wherein

the thermal insulation material (1) having a composition comprising 1% to 20% of a clay mineral by total weight of the composition, 20% to 50% of a base by total weight of the composition, 15% to 40% of a non-halogenated flame retardant by total weight of the composition, 1% to 15% of a non-alkaline borate by total weight of the composition, and 20% to 40% of a starch by total weight of the composition, wherein the base is selected from aluminium hydroxide, magnesium hydroxide, huntite, hydromagnesite, various hydrates, metal phosphates, hydrated calcium, boron compounds, and borates; and

the malleable wrapping material (110) is configured to wrap around the duct or the pipe (120) and capable of forming a hardened core layer having an internal vapor barrier therewithin when exposed to fire or a temperature exceeding 100 ℃, thereby protecting the object (120) from the fire or overheating.

14. The fire and heat protection system according to claim 13, wherein the aluminium foil (30) is reinforced with fiberglass.

15. The fire and heat protection system according to claim 13 or 14, wherein the duct (120) is selected from a grease duct, a chemical exhaust duct, a heating, ventilation, and air conditioning duct, and a life safety duct.

16. The fire and heat protection system according to claim 13 or 14, wherein the pipe (120) is a pipe of a pipe system or pipe penetration system.