Claims

1. A heat-resistant coating composition comprising one or more epoxy resins, one or more polysulfides, one or more spumifics, one or more carbonifics and one or more sources of phosphoric acid;
wherein the mole ratio of thiol groups in the polysulfide(s) to epoxy groups in the epoxy resin(s) is in the range of from 0.20 to 0.50;
and wherein the weight ratio of carbonific(s) to spumific(s) is no more than 0.48 and the weight ratio of carbonific(s) to source(s) of phosphoric acid is no more than 0.38.

2. The heat-resistant coating composition as claimed in claim 1, in which one or more of the following apply:
(a) the weight ratio of carbonific(s) to spumific(s) is in the range of from 0.15 to 0.48;
(b) the weight ratio of carbonific(s) to sources of phosphoric acid is in the range of from 0.10 to 0.38;
(c) the solids content of the composition is at least 50wt%;
(d) the mole ratio of thiol groups in the polysulfide(s) to epoxy groups in the epoxy resin(s) is in a range selected from 0.24 to 0.50, 0.25 to 0.50, 0.20 to 0.45, 0.24 to 0.45 and 0.25 to 0.45.

3. The heat-resistant coating composition as claimed in claim 1 or claim 2, in which one or more of the following apply:
(a) at least one of the sources or all of the sources of phosphoric acid is selected form phosphoric acids and ammonium, organoammonium, alkali metal and alkaline earth metal salts thereof;
(b) at least one of the spumifics or all of the spumifics are selected from urea and its derivatives, melamine and its derivatives, melem (1,3,4,6,7,9,9b-Heptaazaphenalene-2,5,8-triamine) and its derivatives, guanidine and its derivatives, 1,3,5-triazine-2,4,6-trione and its derivatives, and expandable graphite;
(c) at least one of the carbonifics or all of the carbonifics are selected from di-, tri-, tetra-, oligo- and polyhydric alcohols, such as such as glycerol, pentaerythritol,

dipentaerythritol, saccharides hydroxylated polymers, hydrocarbon resins, chloroparaffins, and phosphated plasticisers;

(d) the composition additionally comprises a functional polysiloxane;

(e) the composition additionally comprises an amide or amine-based curing agent;

(f) the composition additionally comprises a cross-linking agent;

(g) the composition additionally comprises fibres

(h) the composition additionally comprises a catalyst.

4. The heat-resistant coating composition as claimed in claim 3, which additionally comprises a cross-linking agent selected from compounds of formula $Si(R^k)_{4-z}(OR^h)_z$, where;

z is an integer in the range of from 1 to 4;

each R^h is independently selected from C_{1-12} aliphatic hydrocarbyl, C_{6-12} aryl, and C_{6-12} aryl substituted with one or more C_{1-6} aliphatic hydrocarbyl groups

each R^k is independently selected from C_{1-12} aliphatic hydrocarbyl, C_{6-12} aryl, and C_{6-12} aryl substituted with one or more C_{1-6} aliphatic hydrocarbyl groups, wherein in R^k each aliphatic hydrocarbyl group, aliphatic hydrocarbyl substituent and aryl group can optionally be substituted with one or more groups selected from halide, $-OR^j$, $-NR^j_2$, and $-SR^j$;

each R^j is independently selected from H, C_{1-6} alkyl and C_{1-6} haloalkyl.

5. The heat-resistant coating composition as claimed in claim 4, in which z is from 1 to 3, and at least one R^k group is selected from C_{1-6} alkyl comprising an $-SR^j$ substituent.

6. The heat resistant coating composition as claimed in any one of claims 1 to 5, in which one or more of the following apply:

(a) the total content of epoxy resins in the composition is in the range of from 5 to 55 wt%;

(b) the total content of polysulfide in the composition is in the range of from 10 to 35 wt%;

(c) the total content of spumific in the composition is in the range of from 5 to 30 wt%;

(d) the total amount of carbonific in the composition is in the range of from 2 to 20 wt%;

(e) the total amount of acid sources in the composition is in the range of from 10 to 50 wt%;

(f) the total amount of cross-linking agent in the composition is no more than 5.0 wt%;

(g) the total amount of catalyst in the composition is no more than 10 wt%;

(h) the total amount of fibres in the composition is in the range of from 0.01 to 15 wt%;

(i) the total amount of functional polysiloxane is in the range of from 0.1 to 20 wt%.

(j) at least one or all sources of phosphoric acid are selected from phosphoric acid and inorganic salts thereof.

7. The heat resistant coating composition as claimed in any one of claims 1 to 6, in which there are no boric acids or borate-containing compounds.

8. The heat resistant coating composition as claimed in any one of claims 1 to 7, which is an intumescent coating composition.

9. The heat resistant coating composition as claimed in any one of claims 1 to 8, which is provided in 2-components comprising a part A and a part B, in which part A comprises at least one or all of the epoxy resins and part B comprises at least one or all of the polysulfides.

10. A method of preparing a heat-resistant coating composition comprising one or more epoxy resins, one or more polysulfides, one or more spumifics, one or more carbonifics, and one or more sources of phosphoric acid, wherein the coating composition is as claimed in any one of claims 1 to 9.

11. Use of a heat-resistant coating composition according to any one of claims 1 to 9 for coating a substrate, wherein the heat-resistant coating composition is applied to a surface of the substrate and allowed to cure.

12. The use as claimed in claim 11, in which the curing takes place a temperature in the range of from -10 to 50 °C.

13. The use as claimed in claim 11 or claim 12, in which the substrate is a metal substrate.

14. A substrate coated with a heat-resistant coating composition as claimed in any one of claims 1 to 9.

15. A substrate as claimed in claim 14, in which the heat-resistant coating composition is cured.