Claims

1. A liquid intumescent coating composition comprising:
   (a) 25.0-75.0 volume % of one more organic thermosetting polymer(s) and curing agent(s) for the organic thermosetting polymer(s),
   (b) 5.0-70.0 volume % of one or more source(s) of phosphoric acid and/or sulphonic acid,
   (c) 1.0-60.0 volume % of one or more source(s) of metal and/or metalloid ion(s) selected from oxides, hydroxides, carbonates, bicarbonates, phosphates, chlorides, sulphates, nitrates, silicates, and borates of Al, Ti, Zn, Cu, Zr, Mg, Na or Ca; and oxides, hydroxides, carbonates of Si and B; and complexes thereof,
   (d) 0.0-5.0 volume % of amine functional blowing agents selected urea, dicyandiamide, melamine and derivatives thereof, provided that the total volume of said amine functional blowing agents is no greater than 25% of the volume of (c),

   wherein volume % is calculated on the total volume of the non-volatile components in the coating composition.

2. The intumescent coating composition of claim 1 which comprises a total of 0-5.0 volume % of said blowing agents (d) and other blowing agents (e), wherein said other blowing agents (e) are selected from expandable graphite, THEIC, sulfamic acid, boric acid, borate salts, tunastanate salts, and derivatives thereof.

3. The intumescent coating composition of claim 2 which comprises a total of 0-5.0 volume % of said blowing agents (d) and (e) and any further components (f) that are capable of imparting a blowing function to a cured coating.

4. The intumescent coating composition of any preceding claim, wherein (a) comprises an organic thermosetting polymer comprising at least one of the following functional groups: epoxy, amine, ester, vinyl, vinyl ester, amide, urethane, mercaptan, carboxylic acid, acryloyl, methacryloyl, isocyanate, alkoxysilyl, anhydride, hydroxyl, alkoxy and polythiol groups.

5. The intumescent coating composition of any preceding claim, wherein (a) comprises an organic thermosetting polymer selected from an epoxy resin, an organopolysiloxane resin, or a combination thereof, and a curing agent selected from an amine, thiol, carboxylic acid, anhydride and/or alcohol functional curing agent.

6. The intumescent coating composition of any preceding claim, wherein (b) is selected from ammonium polyphosphate (APP) or para-toluene sulphonic acid.

7. The intumescent coating composition of any preceding claim wherein (c) is selected from one or more oxides, hydroxides, carbonates, bicarbonates phosphates, chlorides, sulphates, nitrates, silicates, and borates of Al, Ti, Zn, Cu, Zr, Mg, Na or Ca, and complexes thereof.

8. The intumescent coating composition of any preceding claims, wherein (c) is selected from one or more of TiO_2, ZnO, $ZnPO_4$, $Al(OH)_3$, Al_2O_3, $AlPO_4$, Kaolin, MgO, $MgPO_4$ or ZrO_2.

9. The intumescent coating composition of any preceding claim, wherein the organic thermosetting polymer of (a) comprises an epoxy functional resin and an amine functional curing agent.

10. The intumescent coating composition of any of claims 3 to 9, wherein the total volume of the blowing agents (d), (d) + (e), or (d)+(e)+(f), is no greater than 5% of the volume of (c).

11. The intumescent coating composition of any preceding claim wherein the volume % of (c) ranges from 5.0 to 12.0 vol%.

12. A substrate coated with an intumescent coating composition as defined in any preceding claim.

13. A method of protecting structures from fire, by coating the structure with an intumescent coating composition as defined in any of Claims 1-11 and allowing the coating composition to cure.

14. The method of claim 13 wherein the coating composition is allowed to cure at ambient temperature.

Claims

1. A liquid ambient temperature curable intumescent coating composition comprising:

   (a) 25.0-75.0 volume % of one more organic thermosetting polymer(s) and curing agent(s) for the organic thermosetting polymer(s),

   (b) 5.0-70.0 volume % of one or more source(s) of phosphoric acid and/or sulphonic acid,

   (c) 1.0-60.0 volume % of one or more source(s) of metal and/or metalloid ion(s) selected from oxides, hydroxides, carbonates, bicarbonates, phosphates, chlorides, sulphates, nitrates, silicates, and borates of Al, Ti, Zn, Cu, Zr, Mg, Na or Ca; and oxides, hydroxides, carbonates of Si and B; and complexes thereof,

   (d) 0.0-5.0 volume % of amine functional blowing agents selected urea, dicyandiamide, melamine and derivatives thereof, provided that the total volume of said amine functional blowing agents is no greater than 25% of the volume of (c),

   wherein volume % is calculated on the total volume of the non-volatile components in the coating composition.

2. The liquid ambient temperature curable intumescent coating composition of claim 1 which comprises a total of 0-5.0 volume % of said blowing agents (d) and other blowing agents (e), wherein said other blowing agents (e) are selected from expandable graphite, THEIC, sulfamic acid, boric acid, borate salts, tunastanate salts, and derivatives thereof.

3. The liquid ambient temperature curable intumescent coating composition of claim 2 which comprises a total of 0-5.0 volume % of said blowing agents (d) and (e) and any further components (f) that are capable of imparting a blowing function to a cured coating.

4. The liquid ambient temperature curable intumescent coating composition of any preceding claim, wherein (a) comprises an organic thermosetting

polymer comprising at least one of the following functional groups: epoxy, amine, ester, vinyl, vinyl ester, amide, urethane, mercaptan, carboxylic acid, acryloyl, methacryloyl, isocyanate, alkoxysilyl, anhydride, hydroxyl, alkoxy and polythiol groups.

5. The liquid ambient temperature curable intumescent coating composition of any preceding claim, wherein (a) comprises an organic thermosetting polymer selected from an epoxy resin, an organopolysiloxane resin, or a combination thereof, and a curing agent selected from an amine, thiol, carboxylic acid, anhydride and/or alcohol functional curing agent.

6. The liquid ambient temperature curable intumescent coating composition of any preceding claim, wherein (b) is selected from ammonium polyphosphate (APP) or para-toluene sulphonic acid.

7. The liquid ambient temperature curable intumescent coating composition of any preceding claim wherein (c) is selected from one or more oxides, hydroxides, carbonates, bicarbonates phosphates, chlorides, sulphates, nitrates, silicates, and borates of Al, Ti, Zn, Cu, Zr, Mg, Na or Ca, and complexes thereof.

8. The liquid ambient temperature curable intumescent coating composition of any preceding claims, wherein (c) is selected from one or more of TiO_2, ZnO, $ZnPO_4$, $Al(OH)_3$, Al_2O_3, $AlPO_4$, Kaolin, MgO, $MgPO_4$ or ZrO_2.

9. The liquid ambient temperature curable intumescent coating composition of any preceding claim, wherein the organic thermosetting polymer of (a) comprises an epoxy functional resin and an amine fuctional curing agent.

10. The liquid ambient temperature curable intumescent coating composition of any of claims 3 to 9, wherein the total volume of the blowing agents (d), (d) + (e), or (d)+(e)+(f), is no greater than 5% of the volume of (c).

11. The liquid ambient temperature curable intumescent coating composition of any preceding claim wherein the volume % of (c) ranges from 5.0 to 12.0 vol%.

12. A substrate coated with the liquid ambient temperature curable intumescent coating composition as defined in any preceding claim.

13. A method of protecting structures from fire, by coating the structure with the liquid ambient temperature curable intumescent coating composition as defined in any of Claims 1-11 and allowing the coating composition to cure at ambient temperature.