CLAIMS

What is claimed is:

1. A curable resin composition comprising (a) a thermoset resin, (b) a toughener component comprising a multistage polymer and a thermoplastic toughener, and (c) a phenylindane diamine hardener.

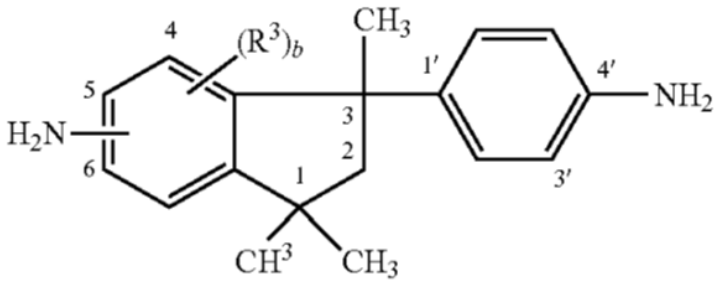
2. The composition of claim 1, wherein the thermoset resin is an epoxy resin.

3. The composition of claim 2, wherein the epoxy resin is selected from a monofunctional epoxy resin, a difunctional epoxy resin, a trifunctional epoxy resin, a tetrafunctional epoxy resin and a mixture thereof.

4. The composition of claim 1, wherein the composition further comprises 4,4'-methylene-bis-(3-chloro-2,6-diethyl-aniline).

5. The composition of claim 1, wherein the thermoplastic toughener is polyethersulfone.

6. The composition of claim 1, wherein the phenylindane diamine hardener is a compound having the structure



where the amino group on the indane ring is at the 5 or 6 position, R^3 is independently hydrogen, halogen or an alkyl group having from 1 to 6 carbon atoms and b is independently an integer of 1 to 4.

7. A curable resin composition comprising

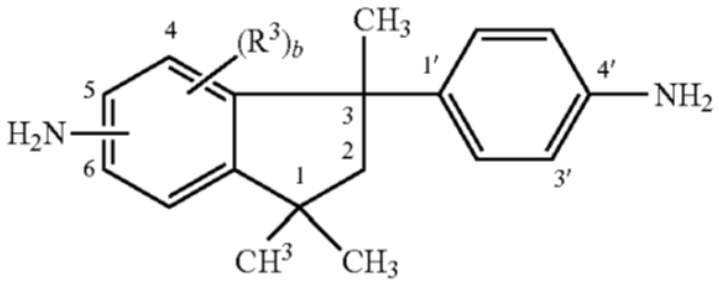
(a) 50 wt.% to 95 wt.% of a thermoset resin,

(b) 1 wt.% to 15 wt.% of a toughener component comprising a multistage polymer and a thermoplastic toughener, and

(c) 5 wt.% to 50 wt.% of a phenylindane diamine hardener, where the wt.% is based on the total weight of the curable resin composition.

8. The composition of claim 7, wherein the toughener component comprises 5 wt.% to 10 wt.% of the multistage polymer and 0.1 wt.% to 10 wt.% of the thermoplastic toughener.

9. The composition of claim 7, wherein the phenylindane diamine hardener is a compound having the structure



where the amino group on the indane ring is at the 5 or 6 position, R^3 is independently hydrogen, halogen or an alkyl group having from 1 to 6 carbon atoms and b is independently an integer of 1 to 4.

10. The composition of claim 7, wherein the thermoplastic toughener is polyethersulfone.

11. A substrate at least partially coated with the curable resin composition of claim 1.

12. The substrate of claim 11, wherein the substrate is metallic piping.

13. The substrate of claim 11, wherein the substrate is non-metallic.

14. The substrate of claim 11, wherein the substrate is a steel pipe, structural steel, a storage tank, a valve or an oil or gas production tubing or casing.

15. A process for forming a coated substrate comprising the steps of:

(a) applying the curable resin composition of claim 1 to a surface of a substrate; and

(b) heating the curable resin composition at a temperature greater than 80°C to cure the curable resin composition.

16. The process of claim 15, wherein the substrate is a metallic pipe.

17. The process of claim 15, wherein the surface is an external surface of the substrate.

18. The process of claim 15, wherein the surface is an internal surface of the substrate.