Summary

[00019] Examples of the present disclosure are defined in the independent claims. Some optional features of the disclosure are defined in the dependent claims. In one exemplary arrangement, there is disclosed a low-halogen thermoplastic polyamide composition comprising a polyamide resin; a copper-containing heat stabilizer; and a non-halogen flame retardant, where the polyamide composition exhibits superior heat stability while maintaining excellent electrical properties. In an example, the polyamide composition has an elemental bromine (Br) content of greater than 900 ppm but less than 1300 ppm. In another example, the polyamide composition has a maximum elemental bromine (Br) content of 900 ppm. In an example, the polyamide composition also has a maximum total halogen content of 1500 ppm.

[00019a] In one aspect, the present disclosure refers to a low-halogen thermoplastic polyamide composition comprising: 50-95% by weight of a polyamide resin; a non-halogen flame retardant, wherein the non-halogen flame retardant is a melamine salt or a melamine complex/adduct; and a copper-containing heat stabilizer comprising a copper halide and an organophosphorus compound, wherein the polyamide composition has an elemental bromine content of greater than 900 ppm but less than 1300 ppm; and wherein the polyamide composition has a maximum total halogen content of 1500 ppm.

[00020] In an example, the low-halogen thermoplastic polyamide composition comprises: a high flow polyamide resin; a non-halogen, nitrogen-containing flame retardant; and a copper-containing heat stabilizer comprising a copper halide and an organophosphorus compound.

[00021] In an example, the heat stabilizer comprises a second copper-containing compound in addition to the copper halide/organophosphorus compound.

[00022] In an example, the polyamide resin is selected from the group consisting of PA-4,6; PA-6,I; PA-6,T; PA-6,6; PA-6/6,6; and mixtures thereof.

[00023] In a particular example, the polyamide resin is PA-6,6.

[00024] In an example, the non-halogen, nitrogen-containing flame retardant is a melamine salt or a melamine complex/adduct.

[00025] In a particular example, the melamine salt or melamine complex/adduct is melamine cyanurate.

[00026] In a particular example, the melamine salt or melamine complex/adduct is melamine polyphosphate.

[00027] In an example, the copper halide of the copper-containing heat stabilizer is a copper(I) halide and the organophosphorus compound is triphenylphosphine.

[00028] In an example, the copper halide of the copper-containing heat stabilizer is a copper(I) halide and the organophosphorus compound is triphenylphosphite.

[00029] In a particular example, the copper(I) halide is copper(I) iodide.

[00030] In a particular example, the copper halide and the organophosphorus compound form a complex.

[00031] In an example, the thermoplastic polyamide composition further comprises a lubricant/mold release agent.

[00032] In an example, the lubricant/mold release agent is a stearic acid salt.

[00033] In a particular example, the stearic acid salt is selected from the group consisting of Al stearate, Zn stearate, Ca stearate and mixtures thereof.

[00034] In an example, the thermoplastic polyamide composition further comprises a colorant.

[00035] In a particular example, the colorant is carbon black.

[00035a] In another aspect, the present disclosure refers to a low-halogen thermoplastic polyamide composition comprising: 50-95% by weight of a polyamide resin; a non-halogen flame retardant, wherein the non-halogen flame retardant is a melamine salt or a melamine complex/adduct; and a copper-containing heat stabilizer comprising a copper halide and an organophosphorus compound, wherein the polyamide composition has an elemental bromine content that is greater than zero and less than 900 ppm; and wherein the polyamide composition has a maximum total halogen content of 1500 ppm.

[00036] In an example, the thermoplastic polyamide composition comprises: 50-95% (such as 55-95%, such as 60-95%, such as 65-95%) by weight of the polyamide resin; 1-30% (such as 1-20%, such as 1-15%, such as 1-10%) by weight of a melamine salt or a melamine complex/adduct as the non-halogen, nitrogen-containing flame retardant; 0.01-10% (0.01-8%, such as 0.01-5%, such as 0.01-4%, such as 0.01-3%, such as 0.01-2%, such as 0.1-8%, such as 0.1-5%, such as 0.1-4%, such as 0.1-3%, such as 0.1-2%, such as 1-8%, such as 1-5%, such as 1-4%, such as 1-3%, such as 1-2%,) by weight of a copper halide/organophosphorus complex as the heat stabilizer; 0-5% (such as 0.1-5%, such as 0.1-4%, such as 0.1 to 3%, such as 1-5%, such as 1-3%) by weight of a lubricant/mold release agent; and 0-5% (such as 0.1-5%, such as 0.1-4%, such as 0.1 to 3%, such as 1-5%, such as 1-3%) by weight of a colorant. In a particular example, the polyamide resin is PA-6,6. In a particular example, the copper halide/organophosphorus complex is a complex of a copper(I) halide with bis(triphenylphosphine). In a particular example, the melamine salt or melamine complex/adduct is melamine cyanurate or melamine polyphosphate. In an example, the lubricant/mold release agent is a stearic acid salt. In a particular example, the stearic acid salt is zinc stearate. In a particular example, the colorant is carbon black.

[00037] An article obtained from the thermoplastic polyamide composition described herein may also be provided. In an example, the article is an automotive part or an electric/electronic part.

[00037a] In another aspect, the present disclosure refers to an article obtained from the thermoplastic polyamide composition according the methods disclosed herein.

Detailed Description of Exemplary Embodiments of the Invention

Claims:

1. A low-halogen thermoplastic polyamide composition comprising:

50-95% by weight of a polyamide resin;

a non-halogen flame retardant, wherein the non-halogen flame retardant is a melamine salt or a melamine complex/adduct; and

a copper-containing heat stabilizer comprising a copper halide and an organophosphorus compound,

wherein the polyamide composition has an elemental bromine content of greater than 900 ppm but less than 1300 ppm; and

wherein the polyamide composition has a maximum total halogen content of 1500 ppm.

2. The thermoplastic polyamide composition according to claim 1, wherein the polyamide resin is selected from the group consisting of PA-4,6; PA-6,1; PA-6,T; PA- 6,6; PA-6/6,6; and a mixture thereof.

3. The thermoplastic polyamide composition according to claim 1, wherein the polyamide resin is PA-6,6.

4. The thermoplastic polyamide composition according to claim 1, wherein the non-halogen flame retardant is a non-halogen, nitrogen-containing flame retardant.

5. The thermoplastic polyamide composition according to claim 1, wherein the melamine salt or melamine complex/adduct is melamine cyanurate.

6. The thermoplastic polyamide composition according to claim 1, wherein the melamine salt or melamine complex/adduct is melamine polyphosphate.

7. The thermoplastic polyamide composition according to claim 1, wherein the copper halide and the organophosphorus compound form a complex.

8. The thermoplastic polyamide composition according to claim 1, wherein the organophosphorus compound is triphenylphosphine.

9. The thermoplastic polyamide composition according to claim 1, wherein the organophosphorus compound is triphenylphosphite.

10. The thermoplastic polyamide composition according to claim 7, wherein the complex is a copper(I) halide/bis(triphenylphosphine).

11. The thermoplastic polyamide composition according to claim 7, wherein the complex is a copper(I) halide/bis(triphenylphosphite).

12. The thermoplastic polyamide composition according to claim 10 or claim 11, wherein the copper(I) halide is copper(I) iodide.

13. The thermoplastic polyamide composition according to claim 1, further comprising a lubricant/mold release agent.

14. The thermoplastic polyamide composition according to claim 13, wherein the lubricant/mold release agent is a stearic acid salt.

15. The thermoplastic polyamide composition according to claim 14, wherein the stearic acid salt is selected from the group consisting of Al stearate, Zn stearate and Ca stearate.

16. The thermoplastic polyamide composition according to claim 1, further comprising a colorant.

17. The thermoplastic polyamide composition according to claim 16, wherein the colorant is carbon black.

18. The thermoplastic polyamide composition according to claim 1, further comprising an additional copper-containing heat stabilizer.

19. A low-halogen thermoplastic polyamide composition comprising:

50-95% by weight of a polyamide resin;

a non-halogen flame retardant, wherein the non-halogen flame retardant is a melamine salt or a melamine complex/adduct; and

a copper-containing heat stabilizer comprising a copper halide and an organophosphorus compound,

wherein the polyamide composition has an elemental bromine content that is greater than zero and less than 900 ppm; and

wherein the polyamide composition has a maximum total halogen content of 1500 ppm.

20. The thermoplastic polyamide composition according to claim 1 or claim 19, comprising:

50-95% by weight of the polyamide resin;

1-20% by weight of a melamine salt or a melamine complex/adduct as the non-halogen flame retardant;

0.01-10% by weight of a copper halide/organophosphorus complex as the heat stabilizer;

0-10% by weight of a lubricant/mold release agent; and

0-10% by weight of a colorant.

21. The thermoplastic polyamide composition according to claim 20, wherein the polyamide resin is PA-6,6; and the copper halide/organophosphorus complex is copper(I) halide/ bis(triphenylphosphine).

22. The thermoplastic polyamide composition according to claim 20, wherein the melamine salt or melamine complex/adduct is melamine cyanurate.

23. The thermoplastic polyamide composition according to claim 20, wherein the melamine salt or melamine complex/adduct is melamine polyphosphate.

24. The thermoplastic polyamide composition according to claim 20, wherein the lubricant/mold release agent is a stearic acid salt.

25. The thermoplastic polyamide composition according to claim 24, wherein the stearic acid salt is zinc stearate.

26. The thermoplastic polyamide composition according to claim 20, wherein the colorant is carbon black.

27. An article obtained from the thermoplastic polyamide composition according to any one of claims 1, 19 and 20.

28. The article according to claim 27, where the article is an automotive part.

29. The article according to claim 27, where the article is an electric or electronic part.