Claims

1. A method of making a fluoropolyether elastomer containing triazine groups and having a glass transition temperature of less than -40°C,
comprising
a) providing

(i) one or more saturated fluoropolyethers containing repeating moieties selected from ($-C_4F_8O-$), ($-C_3F_6O-$), ($-C_2F_4O-$), ($-CF_2O-$) and combinations thereof and further containing at least one functional group at a terminal carbon atom of the backbone chain, or of a side chain if present, wherein the terminal carbon atom may be a primary or secondary carbon atom and wherein the functional group is capable of reacting with a functional group of the fluorinated compound according to (ii) below to form a triazine ring,

(ii) one or more fluorinated compound containing at least one perfluorinated alkyl or perfluorinated alkylene moiety wherein the carbon atoms of the perfluorinated alkyl or alkylene moiety may be interrupted by one or more oxygen atoms and wherein the fluorinated compound further contains at least one functional group capable of reacting with the functional group of the one or more fluoropolyethers to form a triazine,

b) curing the components according to (i) and (ii) to form triazines.

2. The method of claim 1 wherein the fluoropolyether elastomer has a glass transition temperature of less than -80°C.

3. The method according to any one of claims 1 or 2 wherein the one or more fluoropolyethers of (i) have a molecular weight of less than 15,000 g/mole.

4. The method according to any one of the preceding claims wherein the functional group of the fluoropolyethers is a nitrile group.

5. The method according to any one of the preceding claims wherein the functional group of the fluoropolyether is a nitrile group and wherein the functional group of the fluorinated compound comprises a moiety selected from amidines, amidrazones, imidates, amidoxime and salts thereof and combinations thereof.

6. A method of making an elastomer composition having a glass transition temperature of less than -40°C, a tensile strength of at least 1.5 MPa and an elongation at break of at least 50% and comprising a fluoropolyether elastomer having triazine groups, said method comprising

a) providing of

(i) one or more saturated fluoropolyethers containing repeating moieties selected from ($-C_4F_8O-$), ($-C_3F_6O-$), ($-C_2F_4O-$) or ($-CF_2O-$) or combinations thereof and further containing at least one functional group at a terminal carbon atom of the backbone chain or of a side chain if present and wherein the terminal carbon atom may be a primary or secondary carbon atom and wherein the functional group is capable of reacting with a functional group of the fluorinated compound according to (ii) below to form a triazine,

(ii) one or more fluorinated compound containing at least one perfluorinated alkyl or perfluorinated alkylene moiety wherein the carbon atoms of the perfluorinated alkyl or alkylene moiety may be interrupted by one or more oxygen atoms and wherein the fluorinated compound further contains at least one functional group capable of reacting with the functional group of the one or more fluoropolyethers to form a triazine,

(iii) at least one filler,

b) curing the components according to (i) and (ii) to form triazines

7. The method of claim 6 wherein the elastomer composition has an elongation at break of at least 100%.

8. The method according to any one of claims 6 or 7 wherein the elastomer composition has a tensile strength of at least 2 MPa.

9. The method according to any one of claims 6 to 8 wherein the elastomer composition has a shore A hardness of at least 15.

10. A composition comprising a fluoropolyether elastomer containing triazine groups and repeating moieties selected from ($-C_4F_8O-$), ($-C_3F_6O-$), ($-C_2F_4O-$), ($-CF_2O-$) and combinations thereof and at least one filler, the composition having a glass transition temperature of less than -40°C, a tensile strength of at least 1.5 MPa and an elongation at break of at least 50%.

11. The composition of claim 10 wherein the fluoropolyether elastomer is the reaction product of the triazine-forming reaction of

(i) one or more saturated fluoropolyethers containing repeating moieties selected from ($-C_4F_8O-$), ($-C_3F_6O-$), ($-C_2F_4O-$), ($-CF_2O-$) and combinations thereof and further containing at least one functional group at a terminal carbon atom of the backbone chain or of a side chain if present and wherein the terminal carbon atom may be a primary or secondary carbon atom and wherein the functional group is capable of reacting with a functional group of the fluorinated compound according to (ii) below to form a triazine,

(ii) one or more fluorinated compounds containing at least one perfluorinated alkyl or perfluorinated alkylene moiety wherein the carbon atoms of the alkyl or alkylene moieties may be interrupted by one or more oxygen atoms and containing at least one functional group capable of reacting with the functional group of the one or more fluoropolyethers to form a triazine.

12. A curable composition comprising

(i) one or more (saturated) fluoropolyethers comprising repeating moieties selected from ($-C_4F_8O-$), ($-C_3F_6O-$), ($-C_2F_4O-$), ($-CF_2O-$) or combinations thereof and at least one functional group at a terminal carbon atom of the backbone of the fluoropolyether, or of a side chain, if present and wherein the terminal carbon atom may be a primary or secondary carbon atom and wherein the functional group is capable of reacting with a functional group of the fluorinated compound according to (ii) below to form a triazine,

(ii) one or more fluorinated compound containing at least one perfluorinated alkyl or perfluorinated alkylene moiety wherein the carbon atoms of the alkyl or alkylene moiety may be interrupted by one or more oxygen atoms and containing at least one functional group capable of reacting with the functional group of the one or more fluoropolyethers to form a triazine.

13. The curable composition of 12 being a liquid or a paste.

14. A shaped article comprising the composition of any one of claims 10 or 11.

15. A method of making an article comprising injection or compression molding a composition according to any one of claims 12 or 13.

Claims

1. A method of making a fluoropolyether elastomer containing triazine groups and having a glass transition temperature of less than -40°C,
comprising
a) providing

(i) one or more saturated fluoropolyethers containing repeating moieties in the polymer backbone, the repeating moieties being selected from
($-C_4F_8O-$), ($-C_3F_6O-$), ($-C_2F_4O-$), ($-CF_2O-$) and combinations thereof and further containing at least one functional group at a terminal carbon atom of the backbone chain, or of a side chain if present, wherein the terminal carbon atom may be a primary or secondary carbon atom and wherein the functional group is capable of reacting with a functional group of the fluorinated compound according to (ii) below to form a triazine ring,

(ii) one or more fluorinated compound containing at least one perfluorinated alkyl or perfluorinated alkylene moiety wherein the carbon atoms of the perfluorinated alkyl or alkylene moiety may be interrupted by one or more oxygen atoms and wherein the fluorinated compound further contains at least one functional group capable of reacting with the functional group of the one or more fluoropolyethers to form a triazine,

b) curing the components according to (i) and (ii) to form triazines.

2. The method of claim 1 wherein the fluoropolyether elastomer has a glass transition temperature of less than -80°C.

3. The method according to any one of claims 1 or 2 wherein the one or more fluoropolyethers of (i) have a molecular weight of less than 15,000 g/mole.

4. The method according to any one of the preceding claims wherein the functional group of the fluoropolyethers is a nitrile group.

5. The method according to any one of the preceding claims wherein the functional group of the fluoropolyether is a nitrile group and wherein the functional group of the fluorinated compound comprises a moiety selected from amidines, amidrazones, imidates, amidoxime and salts thereof and combinations thereof.

6. A method of making an elastomer composition having a glass transition temperature of less than -40°C, a tensile strength of at least 1.5 MPa and an elongation at break of at least 50% and comprising a fluoropolyether elastomer having triazine groups, said method comprising

a) providing of

(i) one or more saturated fluoropolyethers containing repeating moieties in the polymer backbone, the repeating moieties being selected from $(-C_4F_8O-)$, $(-C_3F_6O-)$, $(-C_2F_4O-)$ or $(-CF_2O-)$ or combinations thereof and further containing at least one functional group at a terminal carbon atom of the backbone chain or of a side chain if present and wherein the terminal carbon atom may be a primary or secondary carbon atom and wherein the functional group is capable of reacting with a functional group of the fluorinated compound according to (ii) below to form a triazine,

(ii) one or more fluorinated compound containing at least one perfluorinated alkyl or perfluorinated alkylene moiety wherein the carbon atoms of the perfluorinated alkyl or alkylene moiety may be interrupted by one or more oxygen atoms and wherein the fluorinated compound further contains at least one functional group capable of reacting with the functional group of the one or more fluoropolyethers to form a triazine,

(iii) at least one filler,

b) curing the components according to (i) and (ii) to form triazines

7. The method of claim 6 wherein the elastomer composition has an elongation at break of at least 100%.

8. The method according to any one of claims 6 or 7 wherein the elastomer composition has a tensile strength of at least 2 MPa.

9. The method according to any one of claims 6 to 8 wherein the elastomer composition has a shore A hardness of at least 15.

10. A composition comprising a fluoropolyether elastomer containing triazine groups and repeating moieties in the polymer backbone, the repeating moieties being selected from ($-C_4F_8O-$), ($-C_3F_6O-$), ($-C_2F_4O-$), ($-CF_2O-$) and combinations thereof and at least one filler, the composition having a glass transition temperature of less than -40°C, a tensile strength of at least 1.5 MPa and an elongation at break of at least 50%.

11. The composition of claim 10 wherein the fluoropolyether elastomer is the reaction product of the triazine-forming reaction of

(i) one or more saturated fluoropolyethers containing repeating moieties in the polymer backbone, the repeating moieties being selected from ($-C_4F_8O-$), ($-C_3F_6O-$), ($-C_2F_4O-$), ($-CF_2O-$) and combinations thereof and further containing at least one functional group at a terminal carbon atom of the backbone chain or of a side chain if present and wherein the terminal carbon atom may be a primary or secondary carbon atom and wherein the functional group is capable of reacting with a functional group of the fluorinated compound according to (ii) below to form a triazine,

(ii) one or more fluorinated compounds containing at least one perfluorinated alkyl or perfluorinated alkylene moiety wherein the carbon atoms of the alkyl or alkylene moieties may be interrupted by one or more oxygen atoms and containing at least one functional group capable of reacting with the functional group of the one or more fluoropolyethers to form a triazine.

12. A curable composition comprising

(i) one or more (saturated) fluoropolyethers comprising repeating moieties in the polymer backbone, the repeating moieties being selected from $(-C_4F_8O-)$, $(-C_3F_6O-)$, $(-C_2F_4O-)$, $(-CF_2O-)$ or combinations thereof and at least one functional group at a terminal carbon atom of the backbone of the fluoropolyether, or of a side chain, if present and wherein the terminal carbon atom may be a primary or secondary carbon atom and wherein the functional group is capable of reacting with a functional group of the fluorinated compound according to (ii) below to form a triazine,

(ii) one or more fluorinated compound containing at least one perfluorinated alkyl or perfluorinated alkylene moiety wherein the carbon atoms of the alkyl or alkylene moiety may be interrupted by one or more oxygen atoms and containing at least one functional group capable of reacting with the functional group of the one or more fluoropolyethers to form a triazine.

13. The curable composition of 12 being a liquid or a paste.

14. A shaped article comprising the composition of any one of claims 10 or 11.

15. A method of making an article comprising injection or compression molding a composition according to any one of claims 12 or 13.