CLAIMS

1. A process for producing a thiol compound, the process comprising:

   i) contacting:

      a) an olefin compound;

      b) H_2S;

      c) diphenylamine and/or a phenol compound; and

      d) a photoinitiator and/or a free radical initiator; and

   ii) forming the thiol compound.

2. The process of claim 1, wherein the phenol compound comprises butylated hydroxytoluene (BHT, dibutylhydroxytoluene), carvacrol, 2,2'-ethylidene-bis(4,6-di-tert-butylphenol), pentaerythritol tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate), or any combination thereof.

3. The process of claim 1, wherein a molar ratio of H_2S to carbon-carbon double bonds of the olefin compound is from about 2:1 to about 150:1.

4. The process of claim 1, wherein:

   an amount of diphenylamine and/or the phenol compound is in a range from about 0.1 wt. % to about 1 wt. %, based on the weight of the olefin compound; and

   an amount of the photoinitiator and/or the free radical initiator is in a range from about 0.05 wt. % to about 5 wt. %, based on the weight of the olefin compound.

5. The process of claim 1, wherein the thiol compound is formed in the presence of ultraviolet light.

6. The process of claim 1, wherein the olefin compound comprises ethylene, propylene, 1-butene, 2-butene, 3-methyl-1-butene, isobutylene, 1-pentene, 2-pentene, 3-methyl-1-pentene, 4-methyl-1-pentene, 1-hexene, 2-hexene, 3-ethyl-1-hexene, 1-heptene, 2-heptene, 3-heptene, 1-

octene, 1-decene, 1-dodecene, styrene, cyclopentene, cyclohexene, cycloheptene, cyclooctene, or any combination thereof.

7. The process of claim 1, wherein the olefin compound comprises limonene, butadiene, isoprene, cyclobutadiene, cyclopentadiene, cyclohexadiene, cyclooctadiene, norbornadiene, vinylcyclohexene, vinylnorbornene, divinylbenzene, cyclopentadiene dimer, trivinylcyclohexane, trivinylbenzene, cycloheptatriene, dimethyl heptatriene, octatriene, cyclooctatriene, cyclododecatriene, cyclooctatetraene, cyclododecatetraene, a polybutadiene, or any combination thereof.

8. The process of claim 1, wherein the process comprises:

contacting the olefin compound, H_2S, diphenylamine, and the photoinitiator; and

forming the thiol compound in the presence of ultraviolet light;

wherein a molar percent conversion of the olefin compound is at least about 90%; and

wherein a percent conversion of the olefin compound is greater than a percent conversion obtained by conducting the process without diphenylamine, under the same reaction conditions.

9. The process of claim 1, wherein the process comprises:

contacting the olefin compound, H_2S, the phenol compound, and the photoinitiator; and

forming the thiol compound in the presence of ultraviolet light;

wherein a percent conversion of the olefin compound is greater than a percent conversion obtained by conducting the process without the phenol compound, under the same reaction conditions.

10. The process of claim 1, wherein a molar percent conversion of the olefin compound is at least about 90%.

11. The process of claim 1, wherein the process further comprises a step of removing at least a portion of the olefin compound, of the H_2S, of the diphenylamine and/or the phenol compound, of the photoinitiator and/or the free radical initiator, or combinations thereof, from the thiol compound.

12. The process of claim 1, wherein the thiol compound is formed in the presence of a solvent.

13. The process of claim 1 wherein at least 65% of the carbon-carbon double bonds of the olefin compound react to form a thiol group.

14. A process for producing a sulfide compound, the process comprising:

i) contacting:

a) an olefin compound;

b) a mercaptan compound; and

c) diphenylamine and/or a phenol compound;

and

ii) forming the sulfide compound;

wherein an amount of diphenylamine and/or the phenol compound is in a range from about 0.05 wt. % to about 5 wt. %, based on the weight of the olefin compound.

15. The process of claim 14, wherein a molar ratio of -SH of the mercaptan compound to carbon-carbon double bonds of the olefin compound is in a range from about 2:1 to about 1:2.

16. The process of claim 14, wherein the mercaptan compound comprises methyl mercaptan, ethyl mercaptan, n-propyl mercaptan, n-butyl mercaptan, t-butyl mercaptan, n-pentyl mercaptan, phenyl mercaptan, mercaptomethanol, 2-mercaptoethanol, 3-mercaptopropanol, 4-mercaptobutanol, 5-mercaptopentanol, 6-mercaptohexanol, or any combination thereof.

17. The process of claim 14, wherein the amount of diphenylamine and/or the phenol compound is in a range from about 0.1 wt. % to about 1 wt. %, based on the weight of the olefin compound.

18. The process of claim 14, wherein the process comprises:

contacting the olefin compound, the mercaptan compound, diphenylamine, and a photoinitiator and/or free radical initiator; and

forming the sulfide compound in the presence of ultraviolet light;

wherein a percent conversion of the olefin compound is greater than a percent conversion obtained by conducting the process without diphenylamine, under the same reaction conditions.

19. The process of claim 14, wherein the process comprises:

contacting the olefin compound, the mercaptan compound, the phenol compound, and a photoinitiator and/or free radical initiator; and

forming the sulfide compound in the presence of ultraviolet light;

wherein a percent conversion of the olefin compound is greater than a percent conversion obtained by conducting the process without the phenol compound, under the same reaction conditions.

20. A process for producing a sulfide compound, the process comprising:

i) contacting:

a) an olefin compound;

b) a mercaptan compound; and

c) diphenylamine and/or a phenol compound; and

ii) forming the sulfide compound;

wherein a molar percent conversion of the olefin compound is at least about 90%.

21. The process of claim 20, wherein the process comprises:

contacting the olefin compound, the mercaptan compound, diphenylamine, and a photoinitiator and/or free radical initiator; and

forming the sulfide compound in the presence of ultraviolet light.

22. The process of claim 20, wherein the process comprises:

contacting the olefin compound, the mercaptan compound, the phenol compound, and a photoinitiator and/or free radical initiator; and

forming the sulfide compound in the presence of ultraviolet light.