IN THE CLAIMS

1. A process comprising:

introducing an aqueous solution with a first hydrocarbon solvent to form an emulsion, wherein the aqueous solution comprises an oxidizing agent and a surfactant;

introducing a cement with the emulsion to form a first mixture within a reactor, wherein the cement comprises a butyl rubber elastomer and a second hydrocarbon solvent that is the same as or different than the first hydrocarbon solvent;

introducing a halogen source with the first mixture contained within the reactor to form a second mixture comprising a halobutyl rubber elastomer;

introducing a neutralizing agent with the second mixture to form a third mixture; and

isolating the halobutyl rubber elastomer from the third mixture.

2. The process of claim 1, wherein the oxidizing agent containing solution is an aqueous solution comprising about 30 wt% to about 40 wt% oxidizing agent.

3. The process of claim 1, wherein the surfactant comprises an ethoxylated alcohol emulsifying agent.

4. The process of claim 2, wherein the oxidizing agent is hydrogen peroxide.

5. The process of claim 1, wherein the aqueous solution comprises an input ratio of surfactant to oxidizing agent of about 1:100 (lbs surfactant:lbs oxidizing agent) to about 3.8:100.

6. The process of claim 1, wherein the first hydrocarbon solvent is selected from the group consisting of pentane, hexane, heptane, and combinations thereof.

7. The process of claim 1, wherein the formation of the second mixture comprises a halogenation reaction between the halogen source and the first mixture contained within the reactor for a residence time of about 0.5 min to about 60 min.

8. The process of claim 1, wherein the butyl rubber elastomer comprises about 18 wt% to about 35 wt% of the cement.

9. The process of claim 1, wherein the second hydrocarbon solvent is selected from the group consisting of pentane, hexane, heptane, and combinations thereof.

10. The process of claim 1, wherein the halogen source is Br_2.

11. The process of claim 10, wherein the peroxide to bromine ratio (mol:mol) is about 0.3:1 to about 0.8:1.

12. The process of claim 10, wherein the bromine to rubber ratio is about 18 kg/Ton to about 45 kg/Ton.

13. A process, comprising:

introducing an aqueous solution with a first organic solvent to form an emulsion, wherein the aqueous solution comprises an oxidizing agent and a surfactant;

introducing a cement with the emulsion to form a first mixture in a reactor, wherein the cement comprises a butyl rubber elastomer and a second organic solvent;

introducing a halogen source with the first mixture contained in the reactor to form a second mixture, wherein forming the second mixture further comprises conducting a halogenation reaction comprising:

reacting the halogen source with the butyl rubber elastomer to form an initial halogenated butyl rubber elastomer and a hydrogen halide,

reacting the hydrogen halide with the oxidizing agent to form a free halide, and

continuing the halogenation reaction to produce additional halobutyl rubber elastomer;

introducing a neutralizing agent with the second mixture to form a third mixture; and

isolating the initial halobutyl rubber elastomer and/or the additional halobutyl rubber elastomer from the third mixture.

14. The process of claim 13, wherein the halogen source is Br_2.

15. The process of claim 14, wherein the bromine utilization of the halogenation reaction is about 60 % to about 90 %, the the residence time of the halogenation reaction is about 1 min to about 25 min, the temperature of the halogenation reaction is about 20 °C to about 70 °C, the halobutyl

elastomers have an initial Mooney viscosity (as determined by ASTM D1646) of about 20 MU to about 50 MU, and the halobutyl elastomers have an increase in Mooney viscosity (as determined by ASTM D1646) of about 2.5 MU to about 5 MU when aged for 7 days at about 80 °C.