CLAIMS

What is claimed is:

1. An apparatus comprising:

an elastomer; and

a swellable metal embedded in the elastomer, wherein a distribution of the swellable metal within the elastomer is nonhomogeneous.

2. The apparatus of claim 1 wherein the elastomer comprises an elastomer selected from the group consisting of cis-l,4-polyisoprene, trans-l,4-polyisoprene, 1 ,2-polyisoprene, 3,4-polyisoprene, synthetic polyisoprene, polybutadiene, polychloroprene, polyisobutylene, chloro butyl rubber, bromo butyl rubber, styrene -butadiene rubber, nitrile rubber, hydrogenated nitrile rubber, ethylene propylene rubber, ethylene propylene diene rubber, epichlorohydrin rubber, polyacrylic rubber, silicone rubber, fluorosilicone rubber, copolymers of hexafluoropropylene and vinylidene fluoride, terpolymers of tetrafluoroethylene, vinylidene fluoride, and hexafluoropropylene, polymers of tetrafluoroethylene, propylene, ethylene, tetrafluoroethylene, and perfluoromethylvinylether, polymers of vinylidene fluoride and hexafluoropropylene, terpolymers of vinylidene fluoride, hexafluoropropylene, and tetrafluoroethylene, terpolymers of vinylidene fluoride, tetrafluoroethylene, and perfluoromethylvinylether, terpolymers of propylene, tetrafluoroethylene, and vinylidene fluoride, and polymers of vinylidene fluoride, hexafluoropropylene, tetrafluoroethylene, perfluoromethylvinylether, and ethylene, polyether block amides, chlorosulfonated polyethylene, ethylene-vinyl acetate, thermoplastic elastomers, polysulfide rubber, and combinations thereof.

3. The apparatus of claim 1 wherein the swellable metal comprises a metal selected from the group consisting of an alkaline earth metal, a transition metal, a lanthanide metal, a post-transition metal, and combinations thereof.

4. The apparatus of claim 1 wherein the swellable metal comprises an alloy comprising a corrosion promoter.

5. The apparatus of claim 1 wherein the swellable metal is present in an amount of about 0.1 wt.% of the elastomer to about 50 wt.% of the elastomer.

6. The apparatus of claim 1 further comprising:

a tubular, wherein the elastomer is disposed on an outside surface of the tubular.

7. A method comprising:

inserting an apparatus into a wellbore, wherein the apparatus comprises:

a seal element comprising:

an elastomer; and

a swellable metal embedded in the elastomer, wherein a distribution of the swellable metal within the elastomer is nonhomogeneous;

exposing the seal element to a fluid; and

transitioning the seal element from an initial state with an initial volume to an expanded state with an expanded volume to form a seal in the wellbore.

8. The method of claim 7 wherein the wellbore comprises a casing, the seal being formed between the seal element and the casing.

9. The method of claim 7 wherein the seal element is disposed on an outside surface of a tubular.

10. The method of claim 7 wherein the seal element is coated with a hydrolysable material.

11. The method claim 7 wherein the elastomer comprises an elastomer selected from the group consisting of cis-l,4-polyisoprene, trans-l,4-polyisoprene, 1,2-polyisoprene, 3,4-polyisoprene, synthetic polyisoprene, polybutadiene, polychloroprene, polyisobutylene, chloro butyl rubber, bromo butyl rubber, styrene-butadiene rubber, nitrile rubber, hydrogenated nitrile rubber, ethylene propylene rubber, ethylene propylene diene rubber, epichlorohydrin rubber,

polyacrylic rubber, silicone rubber, fluorosilicone rubber, copolymers of hexafluoropropylene and vinylidene fluoride, terpolymers of tetrafluoroethylene, vinylidene fluoride, and hexafluoropropylene, polymers of tetrafluoroethylene, propylene, ethylene, tetrafluoroethylene, and perfluoromethylvinylether, polymers of vinylidene fluoride and hexafluoropropylene, terpolymers of vinylidene fluoride, hexafluoropropylene, and tetrafluoroethylene, terpolymers of vinylidene fluoride, tetrafluoroethylene, and perfluoromethylvinylether, terpolymers of propylene, tetrafluoroethylene, and vinylidene fluoride, and polymers of vinylidene fluoride, hexafluoropropylene, tetrafluoroethylene, perfluoromethylvinylether, and ethylene, polyether block amides, chlorosulfonated polyethylene, ethylene -vinyl acetate, thermoplastic elastomers, polysulfide rubber, and combinations thereof.

12. The method of claim 7 wherein the swellable metal comprises a metal selected from the group consisting of an alkaline earth metal, a transition metal, a lanthanide metal, a post-transition metal, and combinations thereof.

13. The method of claim 7 wherein the swellable metal comprises an alloy comprising a corrosion promoter.

14. The method of claim 7 wherein the swellable metal is present in an amount of about 0.1 wt.% of the elastomer to about 500 wt.% of the elastomer.

15. The method of claim 7 wherein the step of exposing comprises:

pumping into a wellbore an aqueous fluid such that the aqueous fluid contacts the seal element.

16. The method of claim 7 wherein the step of transitioning comprises:

drawing the fluid into the seal element;

exposing the swellable metal to the fluid; and

hydrolyzing the swellable metal with the fluid to produce a hydrolyzed metal, wherein the hydrolyzed metal has a greater volume than the swellable metal.

17. A method comprising:

inserting into a wellbore a packer disposed on a tubular, wherein the packer comprises a seal element comprising:

an elastomer; and

a swellable metal embedded in the elastomer, wherein a distribution of the swellable metal within the elastomer is nonhomogeneous;

pumping an aqueous fluid into the wellbore;

exposing the seal element to the aqueous fluid;

hydrolyzing the swellable metal; and

forming a seal between an outer surface of the seal element and an inner surface of the wellbore.

18. The method of claim 17 wherein the elastomer comprises an elastomer selected from the group consisting of nitrile rubber, hydrogenated nitrile rubber, FKM, and combinations thereof.

19. The method of claim 17 wherein the swellable metal comprises a metal selected from the group consisting of magnesium, aluminum, calcium, and combinations thereof.

20. The method of claim 17 wherein the swellable metal comprises an alloy of a metal and a corrosion promoter.