CLAIMS

What is claimed is:

1. A sealing apparatus comprising:

a swellable metal, the swellable metal, when exposed to a fluid, is transitionable from an initial configuration having an initial volume to an expanded configuration having an increased volume, and an encapsulant enclosing at least a portion of the swellable metal;

wherein the encapsulant is porous to permit the fluid to flow through the encapsulant,

wherein the encapsulant at least partially separates the swellable metal from acid;

wherein the swellable metal, upon transitioning to the expanded configuration in an annulus of a fluid channel, forms a seal against a surface of the fluid channel such that fluid communication across the swellable metal in the annulus is at least partially restricted.

2. The sealing apparatus of claim 1, wherein the swellable metal includes at least one of an alkaline earth metal, a transition metal, and a post-transition metal.

3. The sealing apparatus of claim 1, wherein, upon transitioning to the expanded configuration, the volume of the swellable metal increases by greater than 30% when uninhibited by the fluid channel.

4. The sealing apparatus of claim 3, wherein the swellable metal includes at least one of magnesium, aluminum, and calcium.

5. The sealing apparatus of claim 4, wherein the swellable metal includes a dopant that promotes corrosion, and wherein the dopant includes at least one of nickel, iron, copper, cobalt, carbon, tungsten, tin, gallium, and bismuth.

6. The sealing apparatus of claim 1, wherein the swellable metal is a solid piece of metal.

7. The sealing apparatus of claim 1, wherein the swellable metal is in particulate form.

8. The sealing apparatus of claim 7, wherein the swellable metal is carried in a binder, wherein the binder comprises at least one of a degradable binder or a swellable elastomer.

9. The sealing apparatus of claim 1, wherein the encapsulant is configured to rupture when the swellable metal transitions to the expanded configuration.

10. The sealing apparatus of claim 1, wherein the encapsulant is porous, wherein the encapsulant includes at least one of a swellable rubber, neoprene, a polycarbonate material, or a polytetrafluoroethylene.

11. The sealing apparatus of claim 1, wherein the encapsulant encloses the swellable metal by at least one of being wrapped around the swellable metal, molded around the swellable metal, or deposited on the swellable metal.

12. The sealing apparatus of claim 1, wherein at least a portion of the encapsulant is elastic so that the swellable metal expands in a desired direction.

13. A method comprising:

providing a sealing apparatus in an annulus of a fluid channel, the sealing apparatus including a swellable metal and an encapsulant enclosing at least a portion of the swellable metal;

exposing the swellable metal to a fluid such that the swellable metal transitions from an initial configuration having an initial volume to an expanded configuration having an increased volume; and

forming a seal, by the swellable metal in the expanded configuration, against a surface of the fluid channel such that fluid communication across the swellable metal in the annulus is at least partially restricted;

wherein the encapsulant is porous to permit the fluid to flow through the encapsulant, and

wherein the encapsulant at least partially separates the swellable metal from acid.

14. The method of claim13, wherein at least a portion of the encapsulant is elastic so that the swellable metal expands in a desired direction.

15. A system comprising:

a fluid channel with an annulus; and

a sealing apparatus including:

a swellable metal, the swellable metal, when exposed to a fluid, is transitionable from an initial configuration having an initial volume to an expanded configuration having an increased volume, and an encapsulant enclosing at least a portion of the swellable metal;

wherein the encapsulant is porous to permit the fluid to flow through the encapsulant,

wherein the encapsulant at least partially separates the swellable metal from acid; and

wherein the swellable metal, upon transitioning to the expanded configuration in the annulus, forms a seal against a surface of the fluid channel such that fluid communication across the swellable metal in the annulus is at least partially restricted.