Claims

What is claimed is:

1. An apparatus comprising:

a mandrel;

a packer, the packer including:

a constrained portion coupled to the mandrel; and

an unconstrained portion made of a swellable material and coupled to the constrained portion, wherein the unconstrained portion is free to move with respect to the mandrel; and

a spring positioned between the mandrel and the unconstrained portion and configured to urge the unconstrained portion away from the mandrel, the spring having a spring force less than a yield strength of the swellable material when the swellable material is in an unswelled condition.

2. The apparatus of claim 1 wherein the constrained portion of the packer has an outside diameter and is coupled to the mandrel by one or more of: (a) a bond between the constrained portion and the mandrel, (b) a hoop against the outside diameter of the constrained portion to capture the constrained portion against the mandrel, (c) a bond between the constrained portion and a slide around the mandrel, (d) a hoop embedded in the constrained portion to capture the constrained portion against the mandrel.

3. The apparatus of claim 1 wherein the unconstrained portion is made from a material selected from the group consisting of a water-swelling rubber and an oil-swelling rubber.

4. The apparatus of claim 1 wherein the constrained portion is made from a material selected from the group consisting of a non-swelling material, a water-swelling rubber, a water-contracting rubber, and an oil-swelling rubber.

5. The apparatus of claim 1 wherein the constrained portion is bonded to the unconstrained portion by one or more of: (a) an adhesive bond between the constrained portion and the unconstrained portion, or (b) an in-mold bond between the constrained portion and the unconstrained portion.

6. The apparatus of claim 1 wherein the constrained portion is integral with the unconstrained portion.

7. The apparatus of claim 1 wherein the unconstrained portion has a first unconstrained portion part integral with a first end of the constrained portion and a second unconstrained portion part integral with a second end of the constrained portion.

8. The apparatus of claim 1 wherein the constrained portion has a first constrained portion part integral with a first end of the unconstrained portion and a second constrained portion part integral with a second end of the unconstrained portion.

9. The apparatus of claim 8 further comprising a pressure port into a space between the mandrel and the unconstrained portion through one or more of: the mandrel, the unconstrained portion, the constrained portion, or a coupling between the unconstrained portion and the first end of the unconstrained portion.

10. The apparatus of claim 8 further comprising a pressure source coupled to the pressure port, wherein the pressure source is one of: internal to the mandrel or outside the mandrel.

11. The apparatus of claim 1 further comprising reinforcing material embedded in the unconstrained portion.

12. A method for establishing a seal between a mandrel and a borehole comprising:

manufacturing a packer having:

a constrained portion, and

an unconstrained portion made of a swellable material and coupled to the constrained portion;

coupling the constrained portion of a seal element to the mandrel leaving the unconstrained portion free to move with respect to the mandrel;

positioning the mandrel and seal element in the borehole;

providing a spring between the mandrel and the unconstrained portion, the spring configured to urge the unconstrained portion away from the mandrel and having a spring force less than a yield strength of the swellable material when the swellable material is in an unswelled condition; and

energizing the packer so that the unconstrained portion swells away from the mandrel and against the borehole to form a cup.

13. The method of claim 12 further comprising:

binding the unconstrained portion with a dissolvable material.

14. The method of claim 12 wherein energizing the packer includes exposing the unconstrained portion to one or more of: water-based fluid, oil-based fluid, or heat.

15. The method of claim 12 wherein energizing the packer comprises pressurizing a space between the unconstrained portion and the mandrel.

16. The method of claim 12 wherein coupling the constrained portion of the packer to the mandrel includes one or more of: bonding the constrained portion to the mandrel, capturing the constrained portion against the mandrel with a hoop against an outside diameter of the constrained portion, bonding the constrained portion to a sleeve around the mandrel, and capturing the constrained portion against the mandrel with a hoop embedded in the constrained portion.

17. An apparatus comprising:

a mandrel;

a packer, the packer including:

a constrained portion made of a swellable material coupled to the mandrel, and

an unconstrained portion made of a swellable material and coupled to the constrained portion, wherein the unconstrained portion is free to move with respect to the mandrel; and

a spring positioned between the mandrel and the unconstrained portion and configured to urge the unconstrained portion away from the mandrel, the spring having a spring force less than a yield strength of the swellable material when the swellable material is in an unswelled condition.

18. The apparatus of claim 17 wherein the constrained portion is integral with the unconstrained portion.