Claims

What is claimed is:

1. An apparatus comprising:

a mandrel;

a packer ~~having:~~, 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 further comprising a spring to urge the unconstrained portion away from the mandrel.~~

~~7.~~ 6. The apparatus of claim 1 wherein the constrained portion is integral with the unconstrained portion.

~~8~~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.

~~9~~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.

~~10~~9. The apparatus of claim ~~9~~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.

~~11~~10. The apparatus of claim ~~9~~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.

~~12~~11. The apparatus of claim 1 further comprising reinforcing material embedded in the unconstrained portion.

~~13~~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 ~~the~~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.

~~14~~13. The method of claim ~~13~~12 further comprising:

binding the unconstrained portion with a dissolvable material.

~~15~~14. The method of claim ~~13~~12 wherein energizing the packer includes exposing the unconstrained portion to one or more of: water-based fluid, oil-based fluid, or heat.

~~16~~15. The method of claim ~~13~~12 wherein energizing the packer comprises pressurizing a space between the unconstrained portion and the mandrel.

~~17~~16. The method of claim ~~13~~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.

~~18. The method of claim 13 further comprising providing a spring between the mandrel and the unconstrained portion.~~

~~19~~17. An apparatus comprising:

a mandrel;

a packer ~~having~~, 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.

~~20.~~ 18. The apparatus of claim ~~19~~17 wherein the constrained portion is integral with the unconstrained portion.