of a suitable friction reducer comprising acrylamide is a copolymer of acrylamide and acrylic acid. Such friction reducers may further comprise additional monomers, such as 2-acrylamido-2-methylpropanesulfonic acid, N,N-dimethyl acrylamide, vinylsulfonic acid, N-vinyl acetamide, N-vinyl formamide, and mixtures thereof.

[0028] Figure 2 shows a cross-section view of the seal ring backup device **100** oriented similarly (*i.e.*, pressure flows left to right) to the view shown in Figure 1A. The hatched area represents the cross-sectioned portion of the seal ring backup device **100**. In this embodiment, the top surface **118** (Figures 1B and IC) of the seal ring backup device **100** is flat or nearly flat. Once installed, the top surface **118** should make contact with the seal ring **300**.

[0029] In some embodiments, the top surface **118** may be angled, v-ringed or u-cupped, etc. to facilitate the contact between the top surface **118** and the seal ring **300** (Figure 3H). In the embodiment shown in Figure 3H, a seal ring backup device **100** has been installed on opposing sides of the seal ring **300**. Figure 3H also represents the bonding of the seal ring backup devices to the seal ring.

[0030] Referring again to the embodiment shown in Figure 2, the bottom surface is contoured as a wedge **202**. The bottom surface also has a chamfered cut **200**. In some embodiments, the bottom surface **120** may be flat (Figure 3A), convex (Figure 3B), concave (Figure 3C), angled (Figure 3D), stepped (Figure 3E), V-ring or U-cupped (Figure 3G), etc. These shapes allow the seal ring backup device **100** to conform to a variety of existing seal shapes.

[0031] Figures 4A and 4B show at least two embodiments of a sealing system. Referring to Figures 4A and 4B, the seal ring backup device **100** is generally configured to fit into a gland **404** and engage a seal ring **300**. Figure 4A shows an embodiment in which the gland **404** has been machined directly onto a piston rod **402**. Alternatively, Figure 4B shows an embodiment in which the gland **404** has been machined onto the bore **400**.

[0032] Figures 5A-5B show two separate cross-sectional views related to the embodiment shown in Figure 4A. Figure 5A shows the sealing system in a non-sealed state where there is no pressure difference inside the gland. Figure 5B

CLAIMS

The invention claimed is:

1. A seal ring back-up device comprising:

an annular body having an inner diameter, an outer diameter, and a scarf cut; and wherein the annular body is configured to fit a gland and engage a seal.

2. The seal ring back-up device of claim 1 wherein at least one side of the annular body is wedge shaped.

3. The seal ring back-up device of claim 1 wherein the annular body comprises at one selected from the group consisting of: metal, alloy, plastic, amorphous polymer, glass, clay, ceramic, thermoset, epoxy, silica, carbon black, carbon fiber, nanoclay, nanotube, boron, and any combination thereof.

4. The seal ring back-up device of claim 1 wherein the annular body comprises at least one selected from the group consisting of: polyphenylene sulfide, polyaryletherketone, polyimide, polyitaconic acid, sulphone, phenolic, PBI, PI, PA, PEK, PEKK, polymer of ether and ketone, any derivative thereof, and any combination thereof.

5. The seal ring back-up device of claim 1 wherein the annular body further comprises a surface coating comprising at least one selected from the group consisting of: a corrosion inhibitor, a corrosion resistant material, a friction reducer, a wear reducer, TFE, ceramic, and any combination thereof.

6. The seal ring back-up device of claim 1 wherein the annular body comprises at least one surface contour shape from the group consisting of: flat, convex, concave, angled, stepped at the outer diameter, chamfered at the outer diameter, D-ring, Quad-ring, T-ring, V-ring, U-cup, and any combination thereof.

7. The seal ring back-up device of claim 1 wherein the scarf cut is an angled cut extending from the inner diameter of the annular body to the outer diameter of the annular body.

8. The seal ring back-up device of claim 1 wherein the scarf cut has a gap of less than about .002-.010 inches.

9. The seal ring back-up device of claim 1 wherein the annular body has an inner diameter from about 0.5 inches to about 20 inches.

10. The seal ring back-up device of claim 1 wherein the gland is machined onto a piston or a bore.

11. A method comprising:

providing a seal ring back-up device comprising: an annular body having an inner diameter and an outer diameter; and

making a scarf cut on the annular body.

12. The method of claim 11 wherein the scarf cut is made by wire electron discharge machining or casting.

13. The method of claim 11 wherein the annular body comprises one material selected from the group consisting of: a metal, an alloy, a plastic, an amorphous polymer, glass, clay, ceramics, thermosets, epoxies, silica, carbon black, carbon fibers, nanoclay, nanotubes, boron, and any combination thereof.

14. The method of claim 11 wherein the annular body comprises at least one selected from the group consisting of: polyphenylene sulfide, polyaryletherketone, polyimide, polyitaconic acid, sulphone, phenolic, PBI, PI, PA, PEK, PEKK, polymer of ether and ketone, any derivative thereof, and any combination thereof.

15. The method of claim 11 further comprising:

coating the annular body with a surface coating comprising at least one selected from the group consisting of: a corrosion inhibitor, a corrosion resistant material, a friction reducer, a wear reducer, a TFE, a ceramic, and any combination thereof.

16. A method comprising:

providing a seal ring back-up device comprising: an annular body having an inner diameter and an outer diameter;

providing an elastomeric seal ring;

making a scarf cut on the annular body; and

placing the seal ring back-up device and a seal ring in a gland thereby providing a seal in a sealing application.

17. The method of claim 16 wherein the seal ring back-up device is bonded to the seal ring.

18. The method of claim 16 wherein the gland is closed, open, or blind.

19. The method of claim 16 wherein the seal ring back-up device prevents the elastomeric seal ring from deforming into an extrusion gap in the gland.

20. The method of claim 16 wherein the sealing application is full differential or bore to annulus differential on well applications.