[0016] In an embodiment, a prosthetic heart valve for implant at a heart valve annulus comprises a non-expandable, non-collapsible annular support structure defining a flow orifice and having an inflow end. Valve leaflets attach to the support structure and are mount to alternately open and close across the flow orifice. A plastically-expandable stent frame has a first end extending around the flow orifice and connected to the valve at the inflow end of the support structure. The stent frame has a second end projecting in the inflow direction away from the support structure and is capable of assuming a contracted state for delivery to an implant position and a wider expanded state for outward contact with an annulus. The stent frame has an undulating first end with peaks and valleys that conform to a similar shape of the inflow end of the support structure, and the stent frame in the contracted state extends away from the inflow end of the support structure in a tubular portion between the peaks and valleys and then angles inward in a conical portion to the second end. In one embodiment, the stent frame angles inward in a conical portion in the contracted state and the second end defines an orifice that is non-circular, such as by non-uniform crimping.

[0017] An aspect of the present invention provides, a prosthetic heart valve for implant at a heart valve annulus, comprising:

a. a non-expandable, non-collapsible annular support structure defining a flow orifice and having an inflow end;

b. valve leaflets attached to the support structure and mounted to alternately open and close across the flow orifice;

c. a plastically-expandable stent frame having a first end extending around the flow orifice and connected to the valve at the inflow end of the support structure, the stent frame having a second end projecting in the inflow direction away from the support structure and being capable of assuming a contracted state for delivery to an implant position and a wider expanded state for outward contact with an annulus; and

d. an anchoring skirt secured ~~a fabric covering~~ around the stent frame including an enlarged sealing flange arranged to contact the annulus and prevent paravalvular leaking, the ~~fabric~~ enlarged sealing flange comprising a strip of textured PET fabric that has a smooth side and a plush textured side, and the strip is connected at free ends to form a ring

and folded in half about its mid-section to form a double layer with the smooth sides facing each other inward and the plush textured sides facing outward.

WHAT IS CLAIMED IS:

1. A prosthetic heart valve for implant at a heart valve annulus, comprising:

a non-expandable, non-collapsible annular support structure defining a flow orifice and having an inflow end;

valve leaflets attached to the support structure and mounted to alternately open and close across the flow orifice;

a plastically-expandable stent frame having a first end extending around the flow orifice and connected to the valve at the inflow end of the support structure, the stent frame having a second end projecting in the inflow direction away from the support structure and being capable of assuming a contracted state for delivery to an implant position and a wider expanded state for outward contact with an annulus; and

~~a fabric covering~~an anchoring skirt secured around the stent frame including an enlarged sealing flange arranged to contact the annulus and prevent paravalvular leaking, the ~~fabric~~ enlarged sealing flange comprising a strip of textured PET fabric that has a smooth side and a plush textured side, and the strip is connected at free ends to form a ring and folded in half about its mid-section to form a double layer with the smooth sides facing each other inward and the plush textured sides facing outward.

2. The heart valve of claim 1, wherein the sealing flange extends in a ring only around the second end of the stent frame and does not extend up to the first end.

3. The heart valve of claim 2, further including a single layer of textured PET fabric surrounding the stent frame in the areas which don't have the sealing flange to form a plush textured outer surface around the entire stent frame.

4. The heart valve of claim 1, wherein the sealing flange covers the entire exterior of the stent frame.

5. The heart valve of claim 1, wherein the enlarged sealing flange is located only on the interior of the stent frame and the plush textured side provides loops of material that project outward through apertures in the stent frame.

6. The heart valve of claim 1, wherein the enlarged ~~fabric~~ sealing flange has a gradually variable thickness which is thickest at the second end of the stent frame.

7. The heart valve of claim 1, wherein the enlarged ~~fabric~~ sealing flange is vaulted so as to define a cavity filled with a component selected from the group consisting of: absorbent fabric, a swellable polymer, or fibrin glue.

8. The heart valve of claim 1, wherein the anchoring skirt further ~~including~~ includes a fabric cover surrounding the stent frame to the exterior of which the sealing flange attaches.

9. The heart valve of claim 8, wherein the fabric cover is a single piece that is folded at a crease and the second end of the stent frame rests in the fold crease, and wherein free edges of the single piece are connected together at a stitch line at the first end of the stent frame, wherein the first end has peaks and valleys around its periphery.

10. The heart valve of claim 1, further including a sewing ring circumscribing the inflow end of the support structure, wherein the sewing ring comprises a solid yet compressible material that is relatively stiff so as to provide a seal against the annulus and has a concave inflow shape that conforms to the annulus.

11. The heart valve of claim 1, wherein in the contracted state the stent frame is conical, tapering inward from the first end toward the second end.

12. The heart valve of claim 1, wherein the stent frame first end has peaks and valleys, and the stent frame in the contracted state extends away from the ~~sewing ring~~ inflow end of the support structure in a tubular portion between the peaks and valleys and then angles inward in a conical portion to the second end.