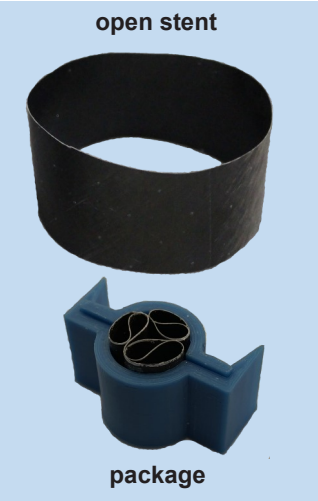
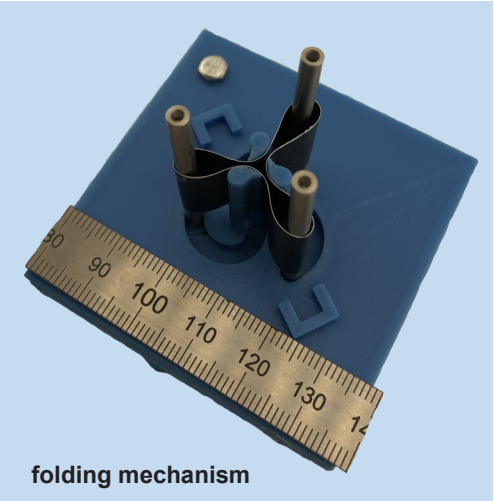
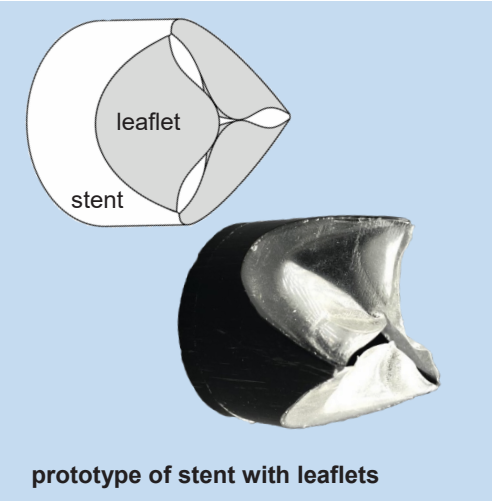
ETH zürich

Licensing Opportunity

Expanding, smooth cylinders for trans-catheter heart valve replacement







Application

In our aging society, more and more people depend on artificial heart valves. A foldable heart valve, which can be placed in the heart by means of a catheter, avoids the need for invasive surgery. The presented stent self-deploys at the target position from a 2.5 times smaller package to become a durable, well fixed implant.

Features & Benefits

- Self-deployable mechanics
- Tuneable fixation forces inside a confined vessel
- Low manufacturing cost
- Optimized interface to leaflet of the valve for improved durability

Publications

- Schlothauer A., Ermanni P., “Stiff composite cylinders for extremely expandable structures”, Sci Rep 9, 15955 (2019), https://doi.org/10.1038/s41598-019-51529-7
- Patent pending

Background

The method of choice for replacing a heart valve under minimal invasive conditions is the transcatheter aortic valve replacement. Valve and stent are moved inside a 9 mm wide catheter to the spot of the aortic heart valve, which is about 25 mm in diameter. The large change in diameter poses high demands on the engineering of the implant and the choice of material.

Invention

The stent consists of ultra-thin cylindrical shells made of fibre reinforced polymer. The elasticity can be optimized to meet the required fixation forces within a given vessel. The stent is folded up for the transport via catheter tube. A compact package can be obtained by pressing the cylinder inwards at multiple points creating a star-like structure, then bending the tips sideways. This packaging method reduces the diameter by at least a factor of 2.5. The stent self-deploys when it is released from the catheter tube. Unlike wire-mesh structures, this stent has no change in length while expanding, thus, exact positioning is facilitated. The procedure has been successfully tested in an explanted swine heart.

Fatigue tests on the stent with attached soft polymer leaflets have been carried out in an artificial circulatory system. No significant fatigue phenomena were observed. Good biocompatibility of all valve components is expected.

Apart from the aortic valve, applications may also include the two larger heart valves (mitral and tricuspid valve), as material properties and the packaging for the trans-catheter transport are optimized.

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Technology Readiness Level

1 2 3 **4** 5 6 7 8 9