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Newsletter

POLYTUBES

Polymer micro-tubes & tubular micro-components

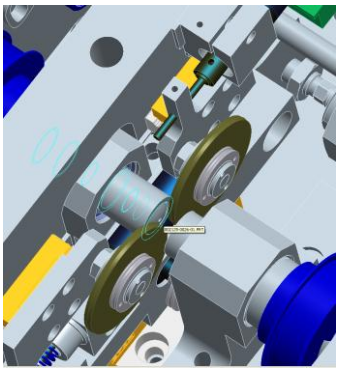
POLYTUBES PROJECT

The overall objective of the POLYTUBES project is to develop a process chain and corresponding micro-manufacturing platform for the manufacture of polymeric micro-tubes and tubular micro-components for medical and non-medical applications. The proposed development aims to create a new market for EU SMEs with innovative and economically competitive micro-products and micro-manufacturing facilities to meet the needs for a wide range of emerging applications. The development will also support the SMEs to increase business opportunities with new volume production capabilities in micro-manufacturing. The proposed development could place EU in a pole position in the manufacture and innovative applications of tubular micro-products.

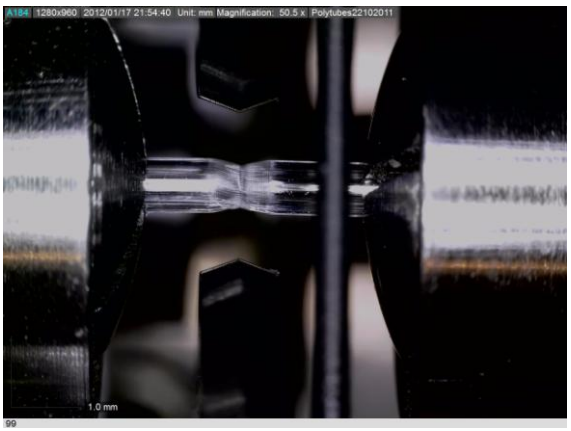
Cross Rolling Machine

For cross rolling the machine design are of great importance since precise shaping is important in most applications. Therefore the design choices in the machine construction are of great importance. To meet the design and tolerance demands.

The objective is to have a machine that are flexible and can make any cross-rolling shape by small changes in size of clamps and shape of shaping-tools. Furthermore the machine should be fully automated and easy to operate.



Design and machine



Process of pressure to a tube where the diameter is reduced

Process

By applying a pressure higher than the yield stress to a material it will take a permanent deformation. The principle in cross rolling is to apply such a pressure to a tube on only two sides while it rotates. In this way the tubes diameter is reduced. It is possible to control the diameter by adjusting the position of the rollers.

When the rollers is removed, and the procession stops, the tube will expand a little corresponding to the yield strain. This gives a demand for the material to have with a low yield strain.

The process must not exceed the maximum strain of the material. If it does so it will usually lead to break, cracks or other types of failure. Therefore materials with relative high maximum strain are preferred. (see figure on next page)

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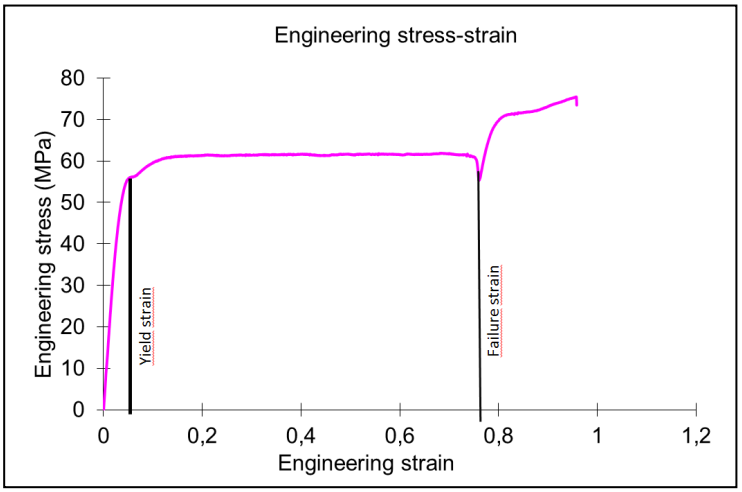
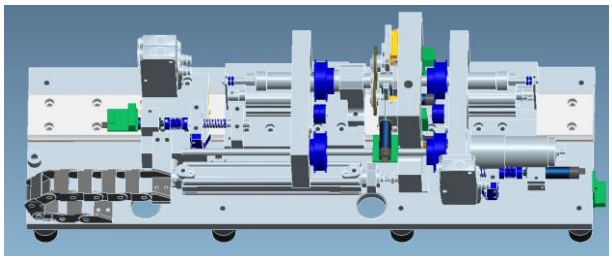
The tubes diameter is reduced in two different material

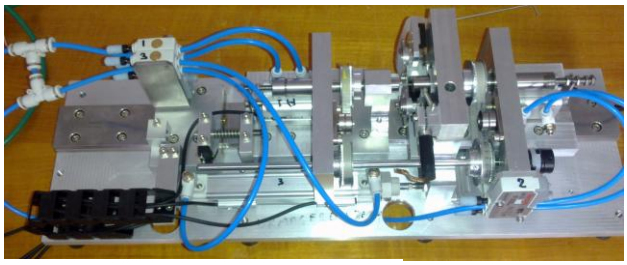
Design

The whole cross rolling machine is 525 x 150 x 150 mm in size.
The rollers are interchangeable with use of only little tools, so that it is possible to do different geometries on the tube.
The tube is clamped firmly by a set of two pneumatic controlled chaublins, so that it can't bend during the process.
The whole setup is mounted on a guide rail, so a small tension can be applied when the tube is narrowed and thereby also extended a little in the length.
The rotation of the tube and the rollers is controlled by two servomotors so the rotational speed of the tube can be adapted to the rotational speed of the rollers giving a minimum of sliding between the rollers and the tube. The speed of the tube can in that way also be increased during processing when the diameter changes to keep the sliding on a minimum.
The pitch of the rollers is controlled by a small servo.
To further minimize the effect of sliding the rollers will be coated to have a minimum coefficient of friction to polymers (optimized to PC).



Engineering stress-strain with yield strain and failure strain





The whole cross rolling machine: design and prototype.

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Can also be used for

The process is a cold forging process, therefore it is possible to do shaping of any materials that can be cold forged, e.g. steel, polycarbonate, COC.

Tests on micro stainless steel tubes (needles) has also been performed.