Empa
Materials Science and Technology

With our novel liquid-core fibers, we focus on different potential fields of applications like adaptive damping systems for vibration control, remote stress and strain sensors, microhydraulic elements within very restricted space, fire protection with liquid flame retardants, and fragrance-releasing fibers for improved ambience.

Liquid-core fibers

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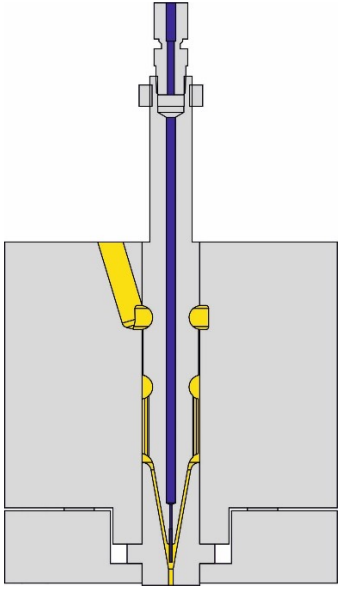
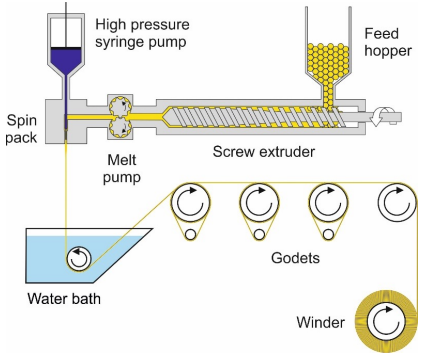


LCF spin pack



LCF spinning line

Based on the principle of bicomponent melt-spinning, Empa's Advanced Fibers lab developed a unique co-extrusion line to produce kilometer-long polymeric filaments with a continuous liquid core. The ability to produce a continuous liquid-core fiber (LCF) is attractive since post-filling of a fine hollow filament would become increasingly slow and uneconomic at extended lengths. In consequence, we designed an extremely versatile microfluidic extrusion process that can be used to create a wide range of LCFs from different polymer-liquid combinations. We are even able to inject a fiber with a shear-thickening fluid, in which the viscosity increases with the rate of shear strain. Such LCFs might enable the design of textiles that can act as adaptive damping systems in vibration control applications. We also designed fibers with a built-in liquid fragrance, which can either be a repellent to drive off insects, or essential oils for olfactory stimulation or scent branding. Pressure-resistant LCFs could even act in soft robotics as microhydraulic elements within very restricted space, actuated by powerful external pumps. First industrial LCF upscaling trials at Monosuisse AG are very promising.