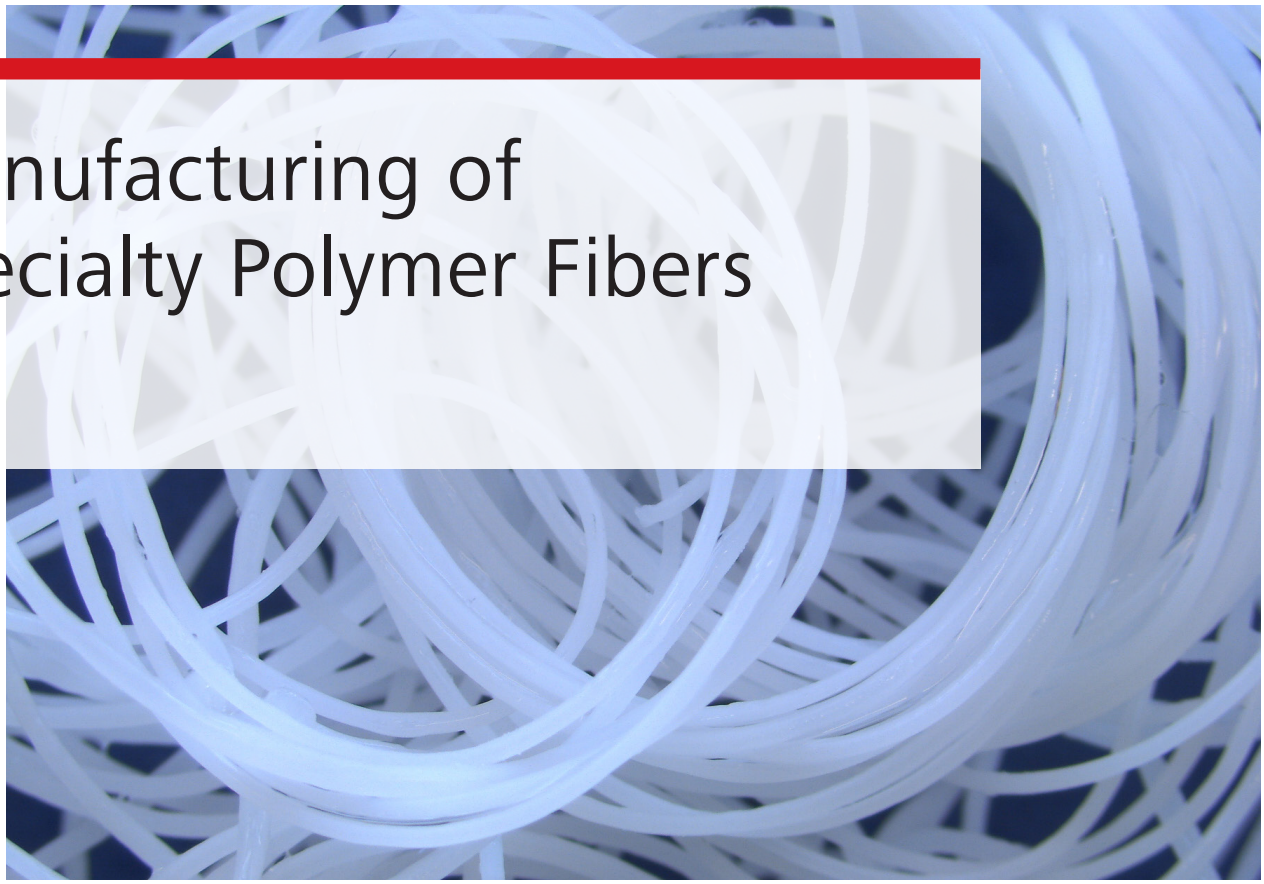
Technology Offer

Empa
Materials Science and Technology

Manufacturing of Specialty Polymer Fibers



Highlights

Next generation manufacturing of

- highly porous polylactide fibers (PLA)
- acrylate polymer optical fibers (POF)
- amphiphilic POFs
- ultrasoft siloxane resin POFs
- polyurethane resin fibers

Applications

- bioactive medical textiles, health monitoring, radiation dosimetry
- biophysical or biochemical sensing, energy harvesting

Background

Certain fibers, such as highly porous PLA, PU resin, acrylate POF, amphiphilic POF and ultra-soft siloxane resin POF, cannot be produced easily by conventional methods (melt spinning, standard wet spinning). However, such fibers are desired for a wide range of applications.

Invention

Empa has established a method which uses microfluidic wet-spinning. In a continuous two-step process (i) a core-shell fiber is produced with the desired polymer as the core, and (ii) the shell is removed in a sodium chloride bath.

Technology Status

Lab prototype established and used to produce, e.g. protein-loaded PLA fibers (>10m); soft PDMS fibers (>1m); acrylate resin optical fibers (>30m).

Technology Readyness Level (TRL) 3-4

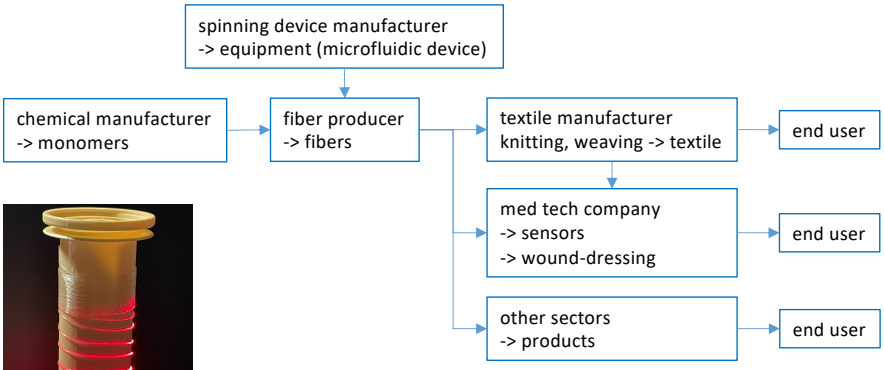
Advantages

The mentioned fibers may be produced by other methods, however such methods are either very time consuming, involve long setup time or many steps, consume too much material or are less controllable, and therefore not suited for efficient or quick manufacturing of small batches at industrial scale, especially for continuous fibers.

Selected Applications

Bioactive molecule-loaded PLA fibers for wound-dressing, sutures and implants
Polymer optical fibers for health monitoring: pressure and oxygen saturation sensing for decubitus ulcers
Energy harvesting textiles (fibers for luminescent solar concentrators)
Scintillation fibers for radiation dosimetry in radiotherapy

Business Model, Partnering



Empa is searching partners according to the above model for a joint development project and/or licensing of the technology. Envisaged next steps during development are > set-up of an industrial scale prototype spinning device > production of fibers for evaluation purposes at potential customers > upscaling.

Ownership

Empa, Swiss Federal Laboratories for Materials Science and Technology, Überlandstrasse 129, CH-8600 Dübendorf; Patent pending

References

Patent application No. WO 2023 209037
PLA fibers: Wang W, et al. Hydrogel-assisted microfluidic wet spinning of poly (lactic acid) fibers from a green and pro-crystallization spinning dope. Chem. Eng. J. 2024, 481: 148417.

Keywords

polymer fibers, resin, polylactide, PLA, siloxane, PDMS, polyurethane, PU, amphiphilic polymers, acrylate, solvent free, spinning, wet spinning, microfluidic spinning, polymer optical fibers, POF, sensing fibers, bioactive molecule containing fibers, soft fibers, porous fibers, solar concentrator fibers, energy harvesting, bioactive textiles, sensing textiles, biochemical sensing, biophysical sensing, medical applications, health monitoring, radiation dosimetry, ambient temperature production.

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