

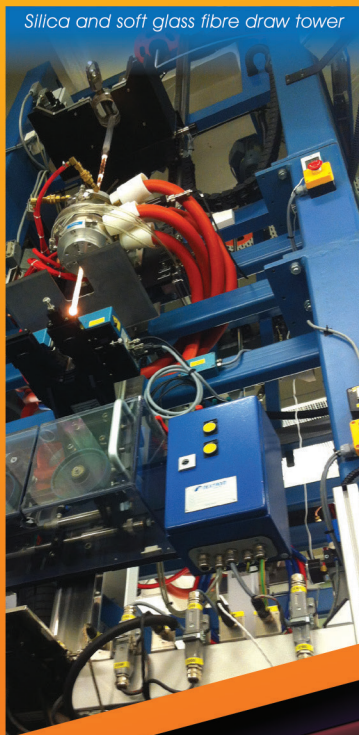


THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

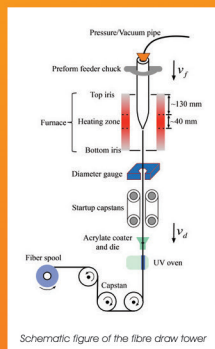
Speciality Optical Fibre Fabrication Laboratory 特種光纖研究實驗室

- *High flexibility*
- *Multi-materials fabrication*
- *Novel fibre sensing techniques*
- *Advanced fibre-processing facilities*

Speciality Optical Fibre Fabrication (SOFF) Laboratory 特種光纖研究實驗室



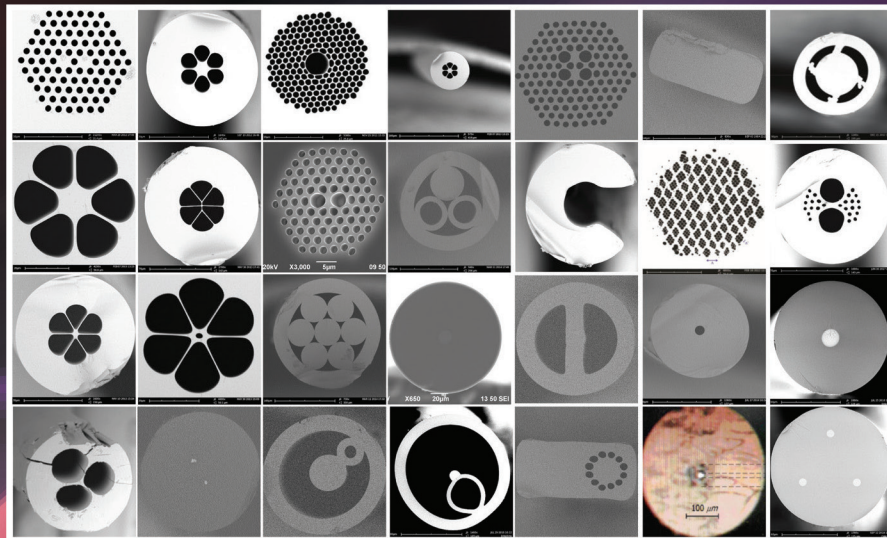
- Supports the fabrication of novel speciality optical fibres (SOFs) with optimised optical and mechanical properties from glass and polymer materials, for sensing applications in the transportation and medical fields
- Aims to expand the capabilities of optical fibre sensors to measure a multitude of parameters to realise optical sensorial networks for the transportation and medical industries



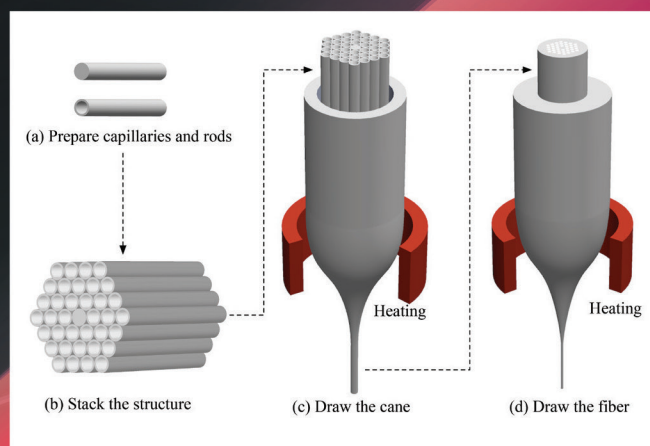
- Is equipped with fibre drawing towers (silica and polymer), grating fabrication laser systems, as well as sensor fabrication and packaging facilities
- Provides novel sensors for the monitoring of large-scale systems, railways, lifts and escalators; as well as for medical projects such as cochlear implants and bone fracture repairs

Objectives

SOFF Laboratory focuses on the fabrication and sensing applications of the speciality optical fibres particularly designed for industrial and medical monitoring. By making full use of the fibre draw towers at PolyU, different kinds of microstructured optical fibres as well as multicore fibres are fabricated. Those specially designed fibres are developed into FBG or interferometric sensors for measuring pressure, acceleration, miniature force, shape sensing, etc. These sensors have been demonstrating impressive performances in measuring pressure and flow rate in the oil industry, monitoring acceleration in railway networks, and detecting miniature contact force in medical implants.



Part of the specialty optical fibers fabricated at Hong Kong PolyU



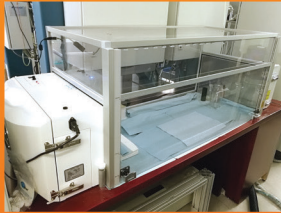
Typical process of fabricating microstructured optical fibres

Fabrication

The fabrication of SOFs utilises the techniques of stack-and-draw, rod-in-tube, drilling, extrusion, as well as standard preform draw. Our SOFs fabricated include:

- Conventional single mode fibre (SMF)
- Conventional multimode fibre (MMF)
- Microstructured optical fibre (MOF)
- Photonic crystal fibre (PCF)
- Thin clad single mode fibre (TC-SMF)
- Multicore fibre (MCF)
- Polymer optical fibre (POF)
- Active optical fibres doped with Er, Yb, etc.

Facilities



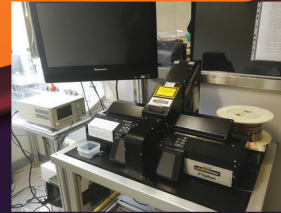
Clean-room box to stack the structure of preform



Desktop SEM machine



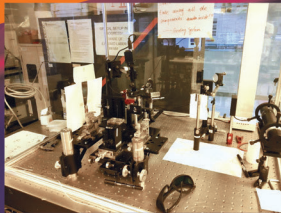
Vytran glassprocessing workstation



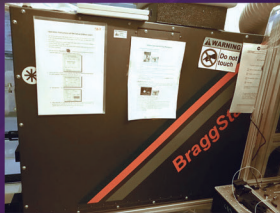
Fujikura LZM-100 glass-processing workstation



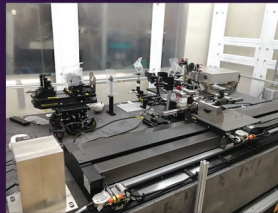
H2/O2 Lathe



193 nm laser FBG fabrication system



248 nm laser FBG fabrication system



213 nm laser FBG fabrication system



Femtosecond laser FBG fabrication system



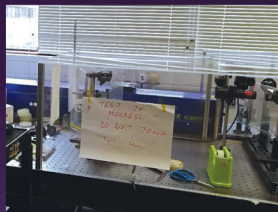
Polymer fibre draw tower



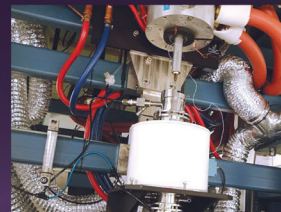
Glove box



Programmable oven



325 nm laser POF grating fabrication system



Soft-glass furnace

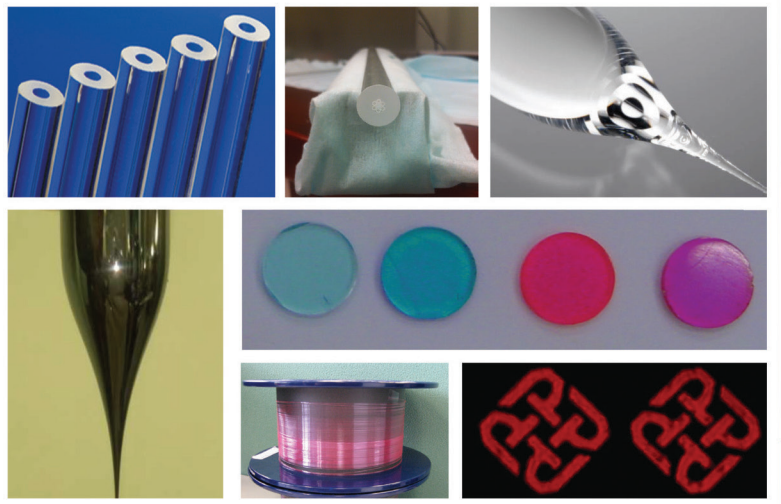
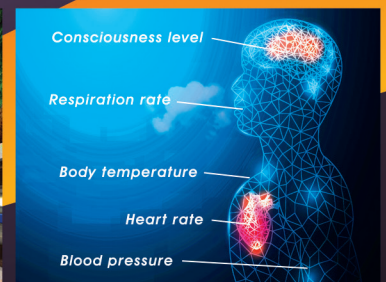
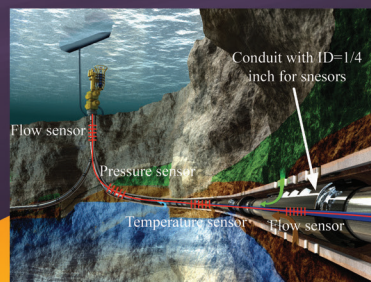
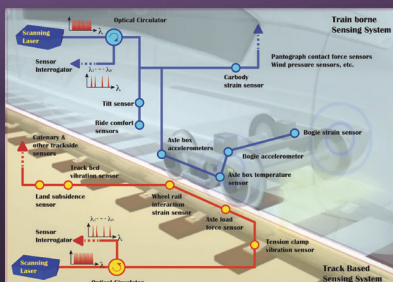
Materials

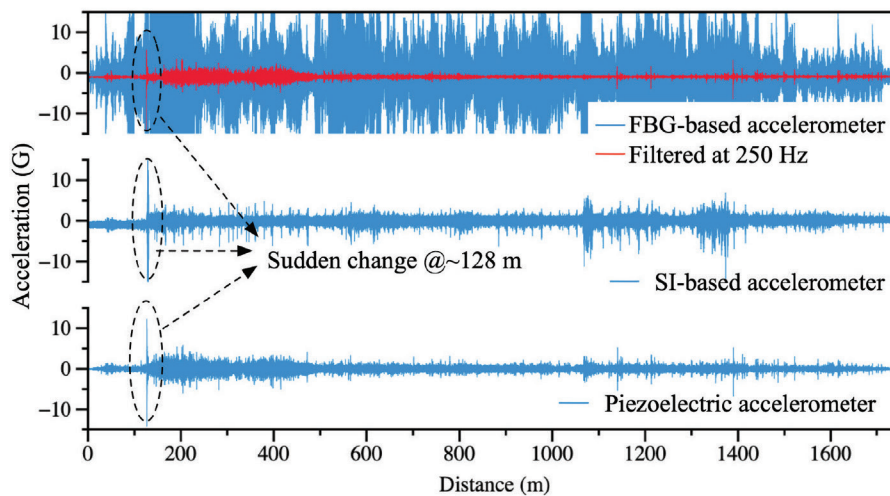
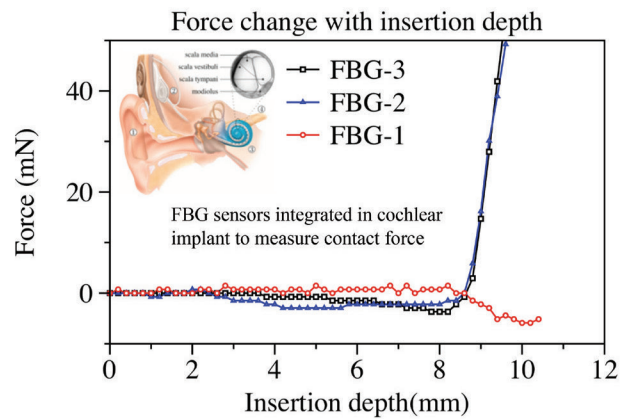
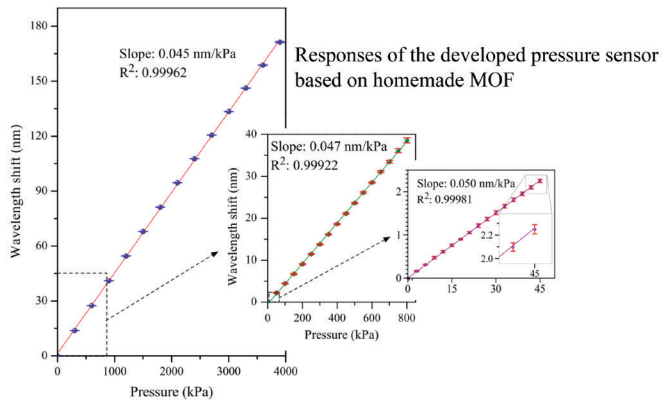
The SOFs are designed and fabricated from different types of materials, including silica glass, soft-glass, and polymers. The drawing temperature of different materials varies from 100 °C to 2000 °C, depending on the melting point of the particular material. Fused glass is most stable and widely used to fabricate SOFs with microstructures, while it is flexible to dope other materials into polymers, e.g. nanoparticles, DPDS, and dyes. Soft-glass includes As₂S₃ and As₂Se₃, while polymer materials include PMMA, TOPAS, Zeonex, etc.

Applications

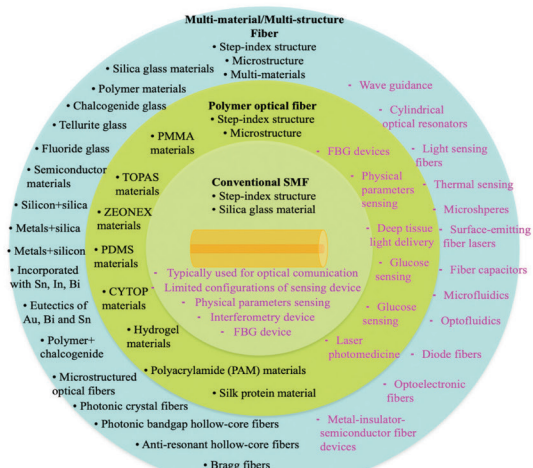
There are three typical sensing applications for our SOFs:

- Railway: structural health monitoring
- Escalators: monitoring of critical components, fatigue of the steel ropes, motors, etc.
- Oil & gas: pressure, temperature and flowrate monitoring
- Medical: vital signs monitoring, surgical implant sensing, shape reconstruction, etc.





Acceleration measurement of different accelerometers installed on the railway



Compared with conventional silica-based fibres, these SOFs provide more options to incorporate different kinds of materials such as chalcogenide glass, semiconductor materials, and even metals. It also allows for different types of microstructures to be introduced into the fibre. In addition, polymer optical fibres offer choices other than classic PMMA, including TOPAS, ZEONEX, PDMS, and some hydrogels. Because of the flexibility of incorporating all these materials, more novel functions have been developed based on the form of optical fibres.

Contact:

Department of Electrical Engineering
The Hong Kong Polytechnic University
Tel: 27664678 Web: <http://www.ee.polyu.edu.hk/en/>

Produced by:

I/E Institute for Entrepreneurship
企業發展院

